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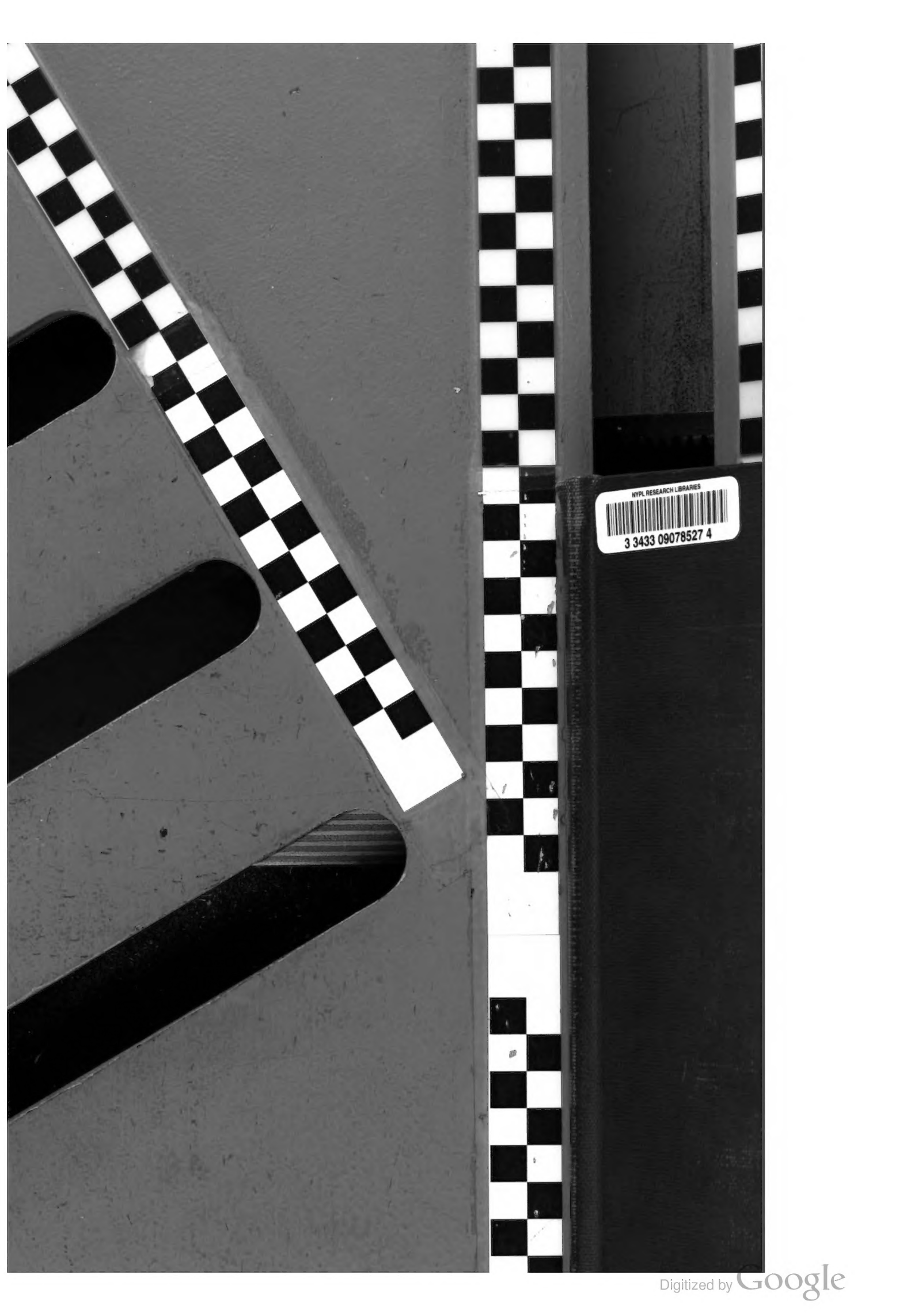
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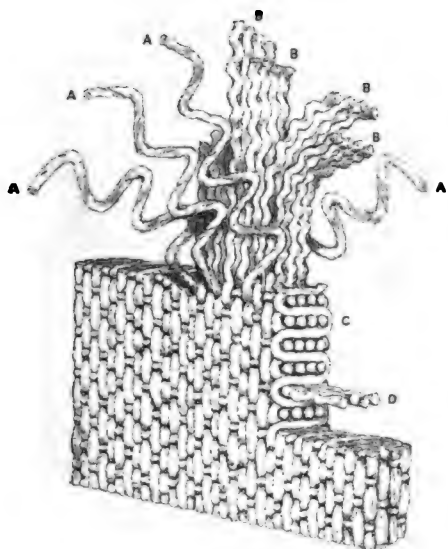




Automotive
3- TOL
+

No 5. P.

Every thread in Rusco BRAKE LINING is a *woven* thread



TO THE man who knows how the best brake lining should be woven, this drawing speaks volumes in quality and perfection. It is not enough that the threads be composed of 90% asbestos and brass wire (as Rusco threads are). Unless every one of those threads is a woven thread, the finished brake lining is going to fall down.

You know what "gutting" threads are

IT IS an absolute fact that brake lining can be woven with "gutting" or filling threads, that lie lengthwise of the fabric, in the center of the fabric, and which in spite of this are really not part of the fabric, because they are not *woven* into it. They merely lie in it to give it bulk. When the wearing surface reaches them, they quickly separate and go to pieces.

What crinkled threads mean

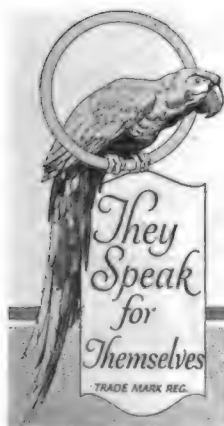
IF YOU braid three strings together and then unbraided them, they look crinkled. The crinkle shows that they have been braided. In the same way, crinkles in Rusco brake lining threads prove that they have been woven into the fabric.

Now see this drawing

THIS is a piece of "raw" Rusco Brake Lining before being treated or compressed. In this drawing are shown sections across the lining, lengthwise of the lining, and also unravelled threads of every kind of thread of which Rusco Brake Lining is composed. The threads labeled "B" are longitudinal threads, each woven into a single ply only. Notice that they are *crinkled* which proves they were *woven*. The threads labeled "A" are binder threads, woven from surface to surface, binding the ply together. Notice their *crinkle* which proves they were woven. "C" shows the path of a binder thread "A," showing how it weaves through and through from surface to surface. "D" are crosswise threads, and notice that these also are *crinkled* and hence *woven*.

The point to remember about RUSCO BRAKE LINING

NINETY per cent by weight of Rusco Brake Lining is asbestos and brass wire. Every thread is a *woven* thread. It will eventually wear out, but it will always give perfect braking.



THE RUSSELL MANUFACTURING COMPANY
MIDDLETOWN, CONN.

RUSCO PRODUCTS



Photograph at the Left Shows Distributor Assembly Room. Those Below are Sections of the J. & L. Machine Room and the Coil Assembly Department.



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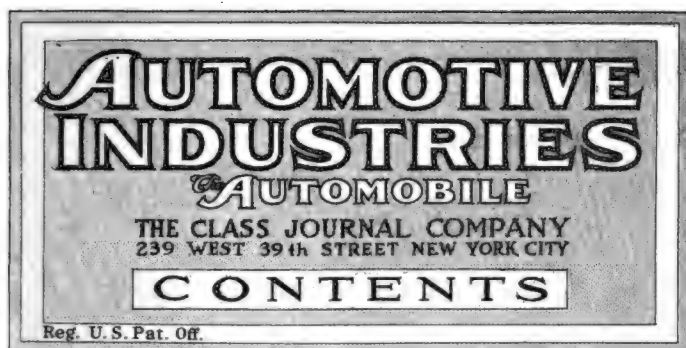
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STARTING LIGHTING IGNITION SYSTEMS

REMY ELECTRIC COMPANY

ANDERSON, INDIANA





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Vol. XLVI New YORK, March 2, 1922 No. 9

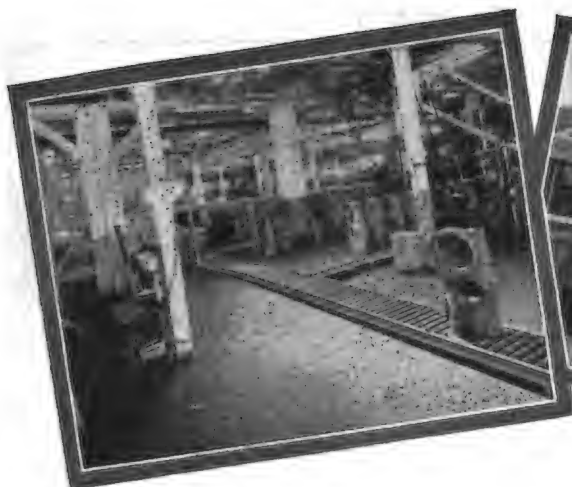
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WYMAN-GORDON
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CONVEYORS

THE position of the United States in the world's automotive markets is thoroughly illustrated by the export statistics provided in the issue of February 16th.

The amount of automotive equipment exported from the United States in comparison with the exports of any other manufacturing country, represents so large a percentage of the total as to indicate the possibilities in the foreign field for the American manufacturer of automotive equipment.

The cultivation of the export field is shown to be well worth while from the standpoint of its possibilities, the position of the United States as the manufacturer of automotive products for the world, and the stability which the growing export business will afford to the domestic market.

HARRY TIPPER

Studebaker
Established 1852



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LAMINUM

AUTOMOTIVE INDUSTRIES

AUTOMOBILE

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No. 9

Can Airships Be Made Fireproof?

The recent Roma disaster brings this question vividly to the fore. We have asked the foremost American authority on lighter-than-air machines to write his answer. He does so here in the most significant article that has been presented on this subject.

By Ralph Upson*

PRACTICALLY every new aircraft accident is from some new cause, yet the large percentage of cases where fire ultimately plays a part is evident to the most casual observer. Even with airplanes, fire is to many persons the most dreaded of any occurrence; and with airships, which are so very safe in most respects, fire is unquestionably the one big risk.

In the past the prevention of airship fires has been attempted mainly by attention to the original causes. This is done by confining the possibility of sparks and flames to properly protected positions. In effect we do the same thing in our houses when we surround our heating, cooking and lighting installations with proper safeguards. It may easily be claimed that almost any fire is due originally to *someone's* carelessness or ignorance. Yet it is equally true that disastrous fires are possible and will continue to occur as long as we use houses largely built of wood. The same is true of airships, unless in some practical way they can be made fireproof. The question is "Can it be done?"

In present-day airships there are three dangerously

inflammable elements: gasoline, hydrogen, and the fabric of the envelope. They are particularly dangerous in combination. The gasoline, by its very nature, is in direct contact with flame in the engines; once ignited, its proximity to the envelope makes possible the burning of a hole through it; the escaping hydrogen then ignites and rapidly spreads the fire over the entire ship. Or the process may be reversed, as it was in the case of the "Roma," where the hydrogen was probably the first to be ignited through a rent in the envelope.

As the hydrogen is in any case the greatest *potential* source of danger, the most obvious remedy is to substitute a non-inflammable gas—hence the development of helium. In proper combination with other safeguards, there is no question as to the ability of helium to do what is claimed for it in any single-envelope airship. Here it is not only non-inflammable itself but will also check any spreading of an envelope fire. In a typical "rigid" airship, however, there is still the liability of the outer cover to burn away and with it enough of the inner gas cell fabric to allow a quick escape of most of the gas.

Helium also has the following practical disadvantages, particularly applying to its commercial use:

*Chairman of Lighter-Than-Air Division, Aeronautic Safety Code Committee.

Limitation of supply to certain natural gas fields, of which there are only 11 or 12 known in the entire world.

The small percentage available, almost never more than 2 per cent by volume, of the natural gas in which helium is found.

The difficulty of separating the helium from other constituents. The only satisfactory method so far discovered is by liquefaction and partial distillation.

Expense of Helium

The above three items make helium *extremely* expensive. The production cost alone is fully 100 times the cost of hydrogen in similar quantities. Add to this the bottling and transportation over long distances with attendant leakage, and it becomes simply prohibitive for practical commercial use.

But still there is another disadvantage that is almost as serious—its deficient lift compared to hydrogen. The accepted standard of quality for helium gives it about 10 per cent less lift than a good commercial hydrogen. This means that the average paying load on a commercial airship would be reduced by nearly half, or the fares, etc., would be practically doubled from this cause alone. In this I have not considered the possibility of a slight admixture of hydrogen, nor, on the other hand, the probable greater weight of fabric and equipment on a helium ship.

Among the remedies that have been proposed for some of these difficulties may be mentioned the following:

1. The sale of various by-products from the original natural gas in order to bring down the cost of the helium. Such products exist, but in most cases they are not true by-products because their extraction is a very simple process compared to that of helium.

In other words, the "cost" of helium may be reduced by applying to it the profits made in some lucrative side business.

2. The use of hydrogen for the main part of the volume, with a layer of helium used only around the outside.

The only things this would help would be the gross lift and the provision of a cheap gas for occasional maneuvering purposes.

The gain in lift would probably be more than offset by the extra weight of the envelope and balloonets, and the loss of gas by diffusion and contamination would be approximately doubled.

3. The use of purification plants at every terminal to keep up the quality of the gas and to avoid the necessity of occasional reinflation.

There are many cases where this would certainly be less expensive than getting all new gas from a distant point.

4. Use of ballast recovery and temperature control apparatus on board to avoid the loss of gas for counterbalancing fuel loss and for maneuvering purposes.

I have been assuming, in any case, the use of some form of ballast recovery equipment.

Temperature control would usually be worth while only on a helium ship, but would, of course, cut down still further the useful lift.

5. In a helium ship the engines might safely be put within the hull, and it is claimed by some that this would permit great savings in resistance and weight, but a thorough analysis of the proposition fails to show the probability of *any* net gain. In other words, we would leave our engines outside on most helium ships as well as on hydrogen ships. The principal exception is in cases where reducing gears are to be used. Then the engines can be mounted inside the hull without so much additional weight.

Summing up the possibilities of helium, we may say that it offers one solution to the problem which should be

very effective for military purposes. But there are serious difficulties attending its commercial use for which there seem to be no immediate remedies. As to what alternatives are available, we must again consider the three main inflammable elements: fuel, lifting gas, and envelope. Generally speaking, the ship will be safe from destruction if any two of these can be rendered non-inflammable. The only alternative not involving a change in the gas is to make non-inflammable the fuel and envelope.

It may seem paradoxical to talk about a "non-inflammable" fuel, but heavy fuel oil, to take the best example, is non-inflammable, so far as requirements for safety are concerned. It is not readily vaporized and can only be ignited in finely divided form, such as is provided for in

the engines themselves. Even kerosene is a comparatively safe fuel. Several promising developments of kerosene and heavy oil engines for aircraft are already under way, and it is practically certain that something satisfactory will be worked out along this line in the rather near future.

Non-inflammable Envelope

The remaining problem is to produce a non-inflammable envelope. Practically, this means the development of an all-metal ship. In such a ship hydrogen would be as safe as helium. For, even assuming a gas leak were ignited in some way, it would only burn as a jet, the same as any gas jet, with no effect on the operation of the ship.

Many other advantages of an all-metal construction are only too obvious and need not be listed here. But there are many difficulties to be overcome to make it a reality. In the meantime prevalent designs of fabric or fabric-covered airships can and will be used with increasing safety, due to accrual of knowledge and experience. In this several of the European countries are in the lead. But the biggest development is yet to come, and opens a wonderful field for American ingenuity and perseverance.

PRACTICAL, commercial problems, as well as theoretical engineering problems, must be met in the development of civil aviation. The substitution of helium for hydrogen gas will render airships far less inflammable, but limitation of supply and high cost render such substitution impracticable from a commercial standpoint at the present time.

Mr. Upson points out as well that the lifting power of helium is about 10 per cent less than that of hydrogen. He outlines the remedies proposed for the difficulties involved in the use of helium, and discusses the possibility of rendering airship fuel and envelope non-inflammable.

If the envelope can be made non-inflammable, hydrogen could be used as safely as helium, since a gas leak, if ignited, would simply burn as a jet.

New Engine Designs at Motor Boat Show

Marine engine development during the past year has been confined chiefly to the very large and the very small sizes. Electric lighting and starting has become a standard feature on larger engines. Some designs are suggestive of aircraft practice. Several 2-cylinder outboard types shown.

TO judge by the marine engines exhibited at this year's motor boat show, which closed in New York, Feb. 26, recent developments in that field have been confined mainly to very small and very large sizes. There has been a considerable increase in the number of small outboard engines, and there were also many large Vee type Otto engines as well as several Diesel engines. Steam also is making its appearance in the motor boat field, and two complete steam power plants, including boilers and engines, were exhibited. Taking the engine exhibits as a whole, a notable improvement in design and in quality of finish is noticeable. Marine engines some years ago were generally quite crude, and this appearance of crudity was emphasized the last few years by the makeshift mountings of electric generators and starters, but most of the engines at this year's show employed one or the other of the S. A. E. standard mountings and therefore presented the appearance of well thought out jobs. In outside finish there also has been a great improvement.

Designers of marine engines seem to be going in for overhead valve engines more strongly than automobile engine designers, and practically all of the overhead valve marine engines have overhead camshafts. Automobile engineers are going rather slow on overhead camshaft engines, because they realize the difficulty of making such engines operate quietly, but in marine work quiet operation does not seem to be considered essential, at least not in the same degree as in automobile practice. These overhead camshaft engines are mostly of large size. They include all of the twelve-cylinder and most of the six-cylinder models shown.

Electric lighting and starting has become a standard feature on boats of the larger types, and practically all of the engines with four or more cylinders were fitted with generators and starters. The makeshift mountings of these units, so conspicuous at former shows, are a thing of the past, and practically all of the installations observed were well carried out. In connection with this trend to provide generators and batteries as regular equipment in boats, there is a noticeable tendency to adopt battery ignition, this tendency being especially apparent in connection with the engines in the lower price range.

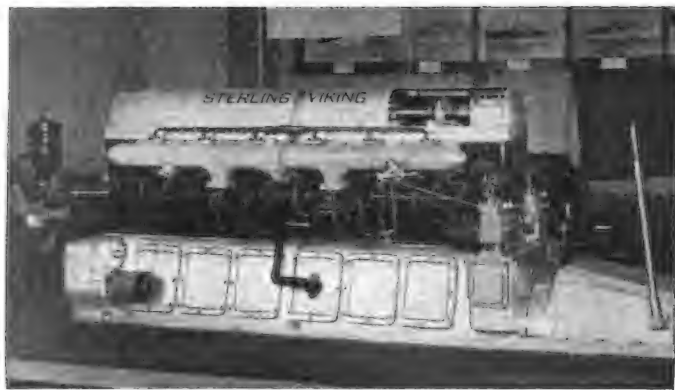
Diesel engines were exhibited by Winton, Sperry and the New London Ship and Engine Co. The engines on the Winton and Nelesco stands were large six-cylinder machines, the Nelesco having been built for use on a canal boat. The New London concern also showed a 100-hp. German M. A. N. Diesel engine, for which make it holds the American manufacturing license. The Sperry engine shown has a rating of 20-hp. and is of the compound type. This engine has been under development for a number of years and has been built for the Government in several sizes. We expect to print a description of this engine in an early issue.

A matter that has caused considerable disturbance in the marine engine industry recently is the refitting of discarded or surplus aircraft engines for marine purposes. On the one hand such converted engines with reversing gear were offered to purchasers at the show, while on the other hand purchasers were being warned against all engines not specially designed for marine work. The argument in favor of the converted aircraft engine is that it can be purchased at a comparatively low price. It is further argued that the engine has been designed to deliver a certain fixed horse power, and as long as it is in good condition it will deliver that horse power no matter where it is installed. The engine, it is said, does not know where it is mounted and furnishes power equally well in an airplane, a boat or an automobile. The warnings referred to emphasized the running cost and alleged that the airplane type of engine was not as reliable and durable as a marine engine should be.

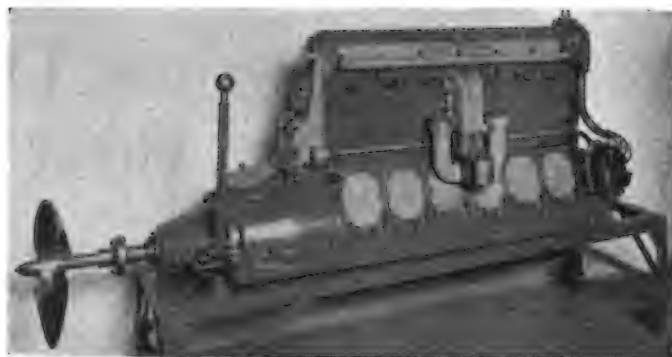
There were several engines shown which, while suggestive of aircraft practice, are still strictly marine engines, being much heavier than would be permissible in aircraft work. An example of this class is the Allison engine manufactured by the Allison Engineering Co. This is a twelve-cylinder Vee engine, delivering 300 hp. at 1000 r.p.m. and 425-hp. at 1500 r.p.m. The cylinder dimensions are $5\frac{1}{2} \times 7\frac{1}{2}$ in. and the engine complete weighs 4400 lbs. The crankshaft is of the seven bearing type, $3\frac{1}{2}$ in. in diameter and hollow. Crankshaft and connecting rods are forged of chrome nickel steel and machined all over, which gives an idea of the quality of design and construction. In fact, it will be observed from the brief description here given that aircraft engine practice has been followed to quite an extent, but the speed has been kept down and special attention has been paid to the requirements of rigidity and durability in marine practice. The cylinders are cast of semi-steel, the upper half of the crankcase is an



Allison twin six Vee engine



The new Sterling Viking six-cylinder engine



The six-cylinder, completely enclosed Isotta-Fraschini

aluminum casting and the lower half a manganese bronze casting. This lower half carries the crankshaft bearings. There are four valves in the head of each cylinder. The two overhead camshafts are driven through shafts parallel with the cylinder axes at the forward end of the engine. There are three spark plugs in each cylinder. Two of these plugs are connected up to magnetos, the engine being fitted with two six-cylinder dual spark magnetos, while the third plug is connected to a battery ignition system. As might be expected, lubrication is by the pressure system, and an electric starter and generator are fitted. The price of this engine with reverse gear is \$25,000.

The same company exhibited a marine generating set comprising a four-cylinder vertical engine direct connected to a generator. Outputs of either 3 or 4 kw. can be obtained from the same unit, evidently by varying the running speed, and the generator can be wound for either 32 or 110 volts.

The Sterling Engine Co. exhibited two new six-cylinder models, of 150 and 300-hp. rating respectively. Both of these have overhead valves and overhead camshafts, the larger engine having dual valves. A feature of this machine which is found in very few marine engines so far is removable cylinder sleeves. The advantages claimed for the sleeve construction are that in the event of wear a sleeve can be easily replaced, and that, since the sleeves are machined both inside and out, there is less chance of distortion in service and consequent leakage and inefficiency. One point that is not being mentioned but which very likely has had considerable weight with the manufacturers is that this method of construction greatly simplifies the foundry problem in connection with producing the cylinder casting. The cylinder block—or water jacket, whatever one wants to call it—is a single casting extending the whole length of the crankcase, and this, of course, tends to greatly stiffen the crankcase. The lower half of the crankcase, which supports the bearings, is made of aluminum for express cruisers, and of cast iron for heavier boats. The upper half is in every case made of aluminum. The crankshaft is made of chrome nickel steel, with seven bearings. This same steel is also used for the connecting rods, which are of the tubular type. It will be noticed that these engines also embody the highest grade construction practice. Pressure feed lubrication is used, the oil being fed under pressure even up to the piston pin bearings. The system employed is that known as the dry base system, which was developed in connection with aircraft work, and which should have advantages in marine work also, especially in rough weather. Aluminum pistons are used in these engines. Ignition is by the battery system. The cylinder dimensions of the two engines are 4-11/16 x 6 in. and 7 x 8½ in.

A 400-hp. engine with overhead valves was shown by the Peerless Marine Motor Co. It is a 12-cylinder Vee

type and weighs only 1400 lb., according to signs displayed, which is a remarkably low weight. This company also exhibited a 125-hp. 4-cylinder engine said to weigh only 750 lbs. and claimed to be the world's lightest marine engine. On the twelve-cylinder the starter and generator are mounted behind the engine proper on the reverse gear housing.

Another big engine known as the Smith marine twin six was exhibited by the New Jersey Motor Sales Co. It has Liberty 5 x 7 in. cylinders and weighs 1250 lbs. The rating is 450-hp.

A pair of very neatly designed engines, a six and a four, were shown by Isotta-Fraschini. They are completely enclosed and have very trim lines. At the front end of these engines there is a cross shaft which drives the magneto from one end and the generator from the other. The starter is fitted to the side of the engine and is geared to the fly wheel. At the rear end of the engine there is an aluminum casting which apparently serves as a jacket cover and which also forms the instrument "board." On it are mounted a tachometer, an oil circulation gage and an oil pressure gage. The camshaft drive is symmetrical in front of the engine. The water pump is of the eccentric type and is mounted on the forward extension of the crankshaft.

Murray & Tregurtha showed a pair of overhead camshaft engines. One of these was obviously a racing engine of very light design. There are two camshafts on this six-cylinder engine, one for the inlet and the other for the exhaust valves. Each camshaft is enclosed in a cylindrical camshaft housing and operates the valves directly through the intermediary of pushrods having their guides in the housing, so that the usual valve rocker levers are dispensed with. Means for the adjustment of the valve clearance are provided on the projecting portions of the push rods. There being push rods between the cams and the valve stems, the camshafts naturally are located a considerable distance above the cylinder heads. Their housings (of aluminum) are supported on the cylinder heads by means of steel studs or columns. This makes a rather light and simple construction.

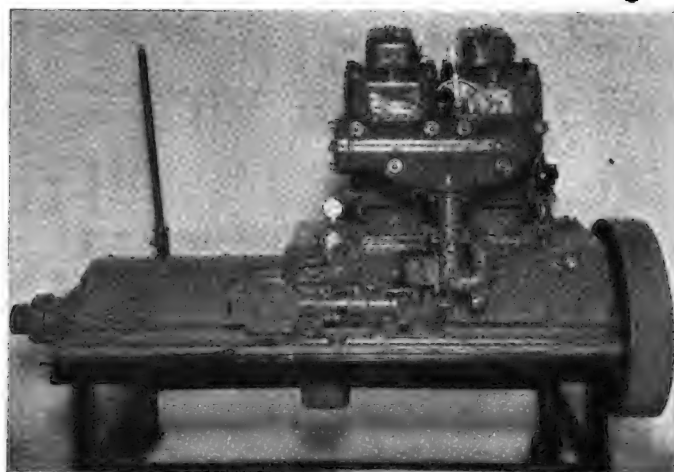
In outboard engines several two-cylinder types are now being offered. These engines are of the two-stroke or two-cycle type and the object in making them in two-cylinder form, notwithstanding their small output, is to improve the balance. The cylinders being arranged horizontally on opposite sides of the crankshaft, to gain this end it is necessary to use a two-throw crankshaft and to have the two cylinders fire at the same time. Formerly flywheel magnetos were the almost universal equipment on these engines, but now an option on either battery or magneto ignition is given by most makers.

Strong efforts have been made to reduce weight of outboard engines. The new 2-cylinder Elto, rated at 3 hp.,

weighs 48 lb. The Johnson outboard engine weighs only 35 lb. and is probably the lightest engine of this type made. A material reduction in weight has also been made by the Evinrude Motor Co. in its new 2-hp. outfit.

Motor-boat service is very similar to tractor service, in that the engines have to operate at nearly full load practically all the time, and it is therefore not surprising that a number of firms which specialize in tractor engines should also build marine engines. When Joe Van Blerck got out his new J. V. B. engine he at once offered it in both a tractor and a marine type, and now the Stearns Motor Mfg. Co., another manufacturer of tractor engines, has also entered the marine field.

An historical exhibit of interest was shown by the Consolidated Shipbuilding Corporation in the form of a naphtha launch built about 35 years ago, before the advent of the gasoline motor boat. Its powerplant operated on the same principle as a steam power plant, but low boiling point naphtha was used as the working fluid. Sectional diagrams of the working mechanism were shown mounted on a board, and it was stated that these launches enjoyed considerable vogue for several years, but that



Two-cylinder model of the new Frisbie heavy-oil type engine

when the gasoline launch appeared on the scene the demand for them decreased.

A New Motor Operated Horn

BY the use of a novel construction for the motor, the Briggs & Stratton Co. have been able to use a single field coil in the new motor-driven horn which they have recently brought out. The new construction has so simplified the manufacture of the horn that, based on a quantity-production basis, the horn will have a list price of but \$5. There is a minimum of interior wiring. The horn is a concentric type.

In the design of the horn an effort has been made to remove the necessity for attention on the part of the owner or service station. It has been found that a large percentage of horn trouble usually encountered is due to either too much or too little lubrication. On the new horn a specially impregnated fiber is used which eliminates the necessity for lubrication and also is designed to exclude moisture.

An unusual feature in the motor is the new brush rigging which has been designed with the intention of making it impossible for the brushes to stick. The brushes are not lubricated, as there is one carbon and one copper brush. By the design of the brush rigging with a single coil spring between the two brushes, which are mounted on a sub-assembly, equal pressure is always exerted on the brushes. As shown by the sketch, the brush replacement is very simple.

The horn has been so designed that the cover can be

easily removed and parts disassembled by removing two nuts, making it a simple matter to replace any worn parts. The horn can be taken apart so quickly that the customer can be informed at once exactly how much it will cost to make any replacements. This quality permits the service station to make the profit on the merchandising of material rather than on labor, and at the same time cuts down the amount of time the car is tied up for horn service.

Adjustment of the horn can be made externally by the use of a screw driver. The slot is so sized that a coin can be used if no screw driver is available. Two types of brackets are provided so that practically any car can be fitted. There is only one type of horn manufactured, but provision is made for a 12-volt circuit by putting on an external resistance. This eliminates the necessity for carrying more than one type of horn in stock. An important claim which is made for the horn is that the design is such that changes in weather conditions do not affect it in any way.

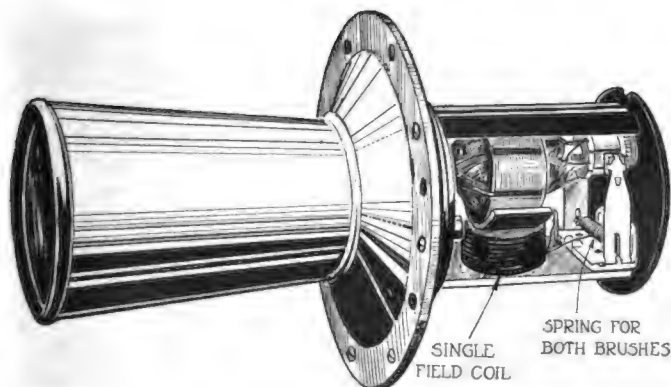
Auditing, Theory and Practice

THE third edition of "Auditing, Theory and Practice," by Dr. R. H. Montgomery, has just been published by the Ronald Press Company. The present edition is in two volumes and the second will not be ready for distribution for a few months.

This book, which has long been recognized as an authority on matters of auditing and accounting, has been brought up to date. Changes in economic conditions brought about by the war necessarily led to changes in systems and methods, and these are all brought out by the author. It is for this reason that the book is actually a new book rather than a new edition. Fully 200 of the pages are entirely new text.

The first volume of the book deals with the general principles of auditing and the second to the application of these principles.

THE weight of Haskelite Mfg. Corp. quarter-inch body panels is given as .073 pounds per square foot in the Feb. 16 issue. The weight should have been given as 0.73.



Detail of the new Briggs & Stratton motor operated horn

Cooling Capacity Increased in Samson Tractor

Improvements in lubricating and cooling systems have recently been made in the Samson Model M tractor. Cooling capacity is materially increased by enlarging radiator and fan. Here is the first detailed engineering description of this tractor with sectional view of chief components.

By P. M. Heldt

ALTHOUGH the Samson tractor is not a new product, a technical description of the machine at this time should prove of interest because no sectional views of the chief components have ever been shown in the past and very little is known concerning the internal construction of the tractor except possibly to service men and some users. Since it was introduced in the fall of 1919 this tractor has been widely distributed, and it has been decided to continue the same model for another year, with improvements as indicated in the course of this article.

As shown by the photographs, the tractor is of the frameless type, the engine being bolted with its bell housing to the forward flange of the transmission, which latter forms a unit with the rear axle housing. The tractor is of the lighter and more compact type and is geared to operate at slightly over 3 m.p.h. in light soil.

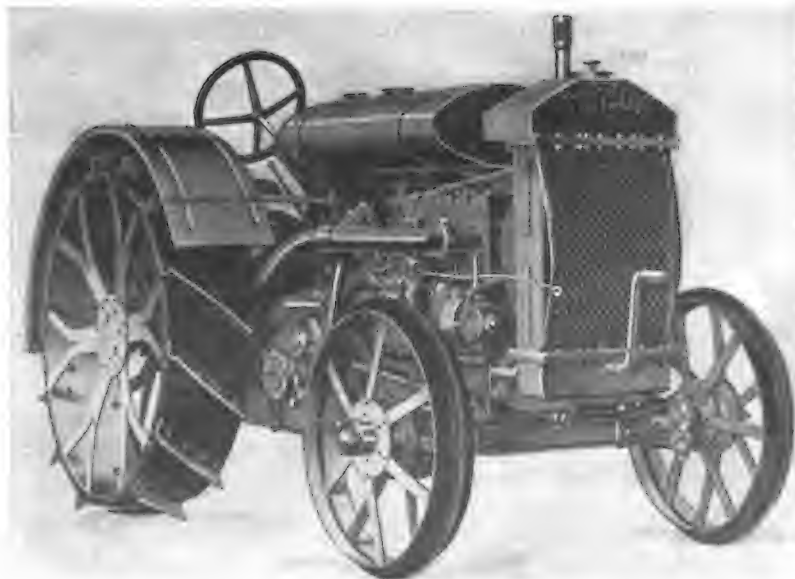
The engine is a four-cylinder block-cast type of 4-in. bore and 5½-in. stroke. Its cylinders are of the L-head type, the valves being seated directly on the cylinder casting, which tends to insure effective cooling. The compression chamber, which is made comparatively large so as to permit of the use of kerosene as fuel, is formed by the union of the removable head and the cylinder block. There are communicating passages between the jackets of the cylinder block and the cylinder head, so that the heads, too, are effectively water-cooled.

The crankshaft, camshaft and connecting rods are heat-treated steel forgings. All bearings on the crankshaft are of a dense babbitt alloy, brass-backed, while the camshaft runs directly on the cast iron of the cylinder casting. The pistons are made of cast iron and are fitted with three compression rings above the piston pin and an oil scraper ring near the lower end of the skirt. The timing gears are of cast iron and are cut with helical teeth.

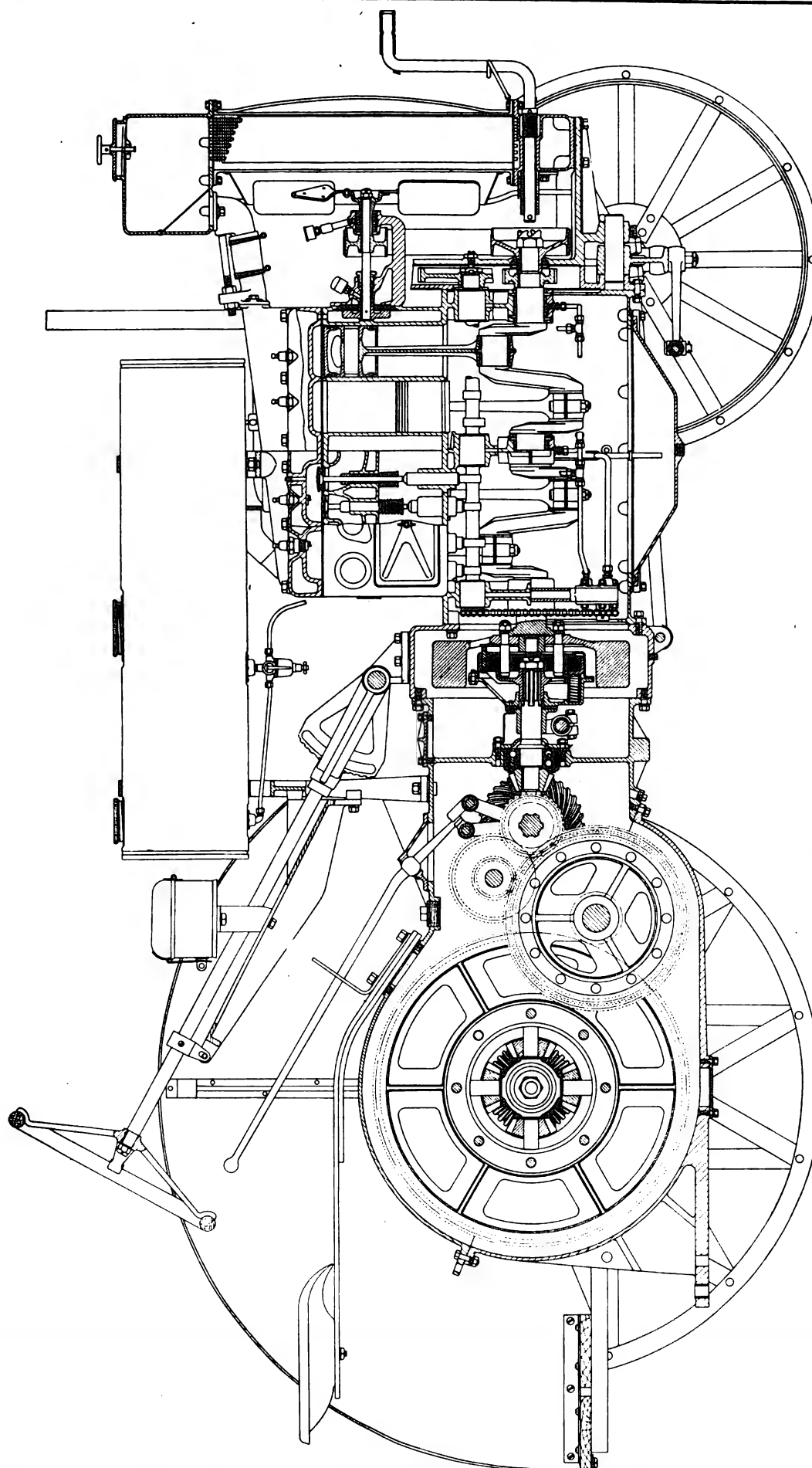
Lubrication of all engine bearings is accomplished by pressure feed from a gear pump located in the bottom of the crankcase, and oil thrown from the crank arms and connecting rod cheeks furnishes lubrication for the pistons, piston pins and valve tappets. A removable cast iron oil pan permits easy access to the interior of the crankcase for inspection and minor repairs. There are no oil line connections or other attachments to this pan. An improvement made to the lubricating system during the past year consists in the provision of an oversize oil pump with a by-pass valve, which results in a degree of uniformity of oil pressure on all bearings regardless of the temperature or fluidity of the oil. The overflow from the bypass valve is used to lubricate the timing gears and governor mechanism.

Circulation of the cooling medium is effected by means of an impeller of the type used in centrifugal pumps, which operates in a housing cast integral with the cylinder block. A large diameter pressed steel fan is mounted directly on the pump shaft and the pump and fan are driven from the crankshaft by a single belt. The cooling system, too, has been redesigned during the past year, with the object of adding to its cooling capacity. A radiator of increased capacity, though of the same general type as the previous one, has been adopted, and the fan has been considerably increased in size and its speed has been raised to give increased air flow. Formerly a plain bearing was used on the fanshaft, which now has both a plain and a Hyatt bearing. A flat belt has replaced the vee belt and is kept taut by a spring tension idler. The radiator consists of cast iron top and bottom tanks and cast iron side columns, which parts enclose a finned tubular core. Water is used as a cooling medium in warm weather and kerosene in winter in cold climates.

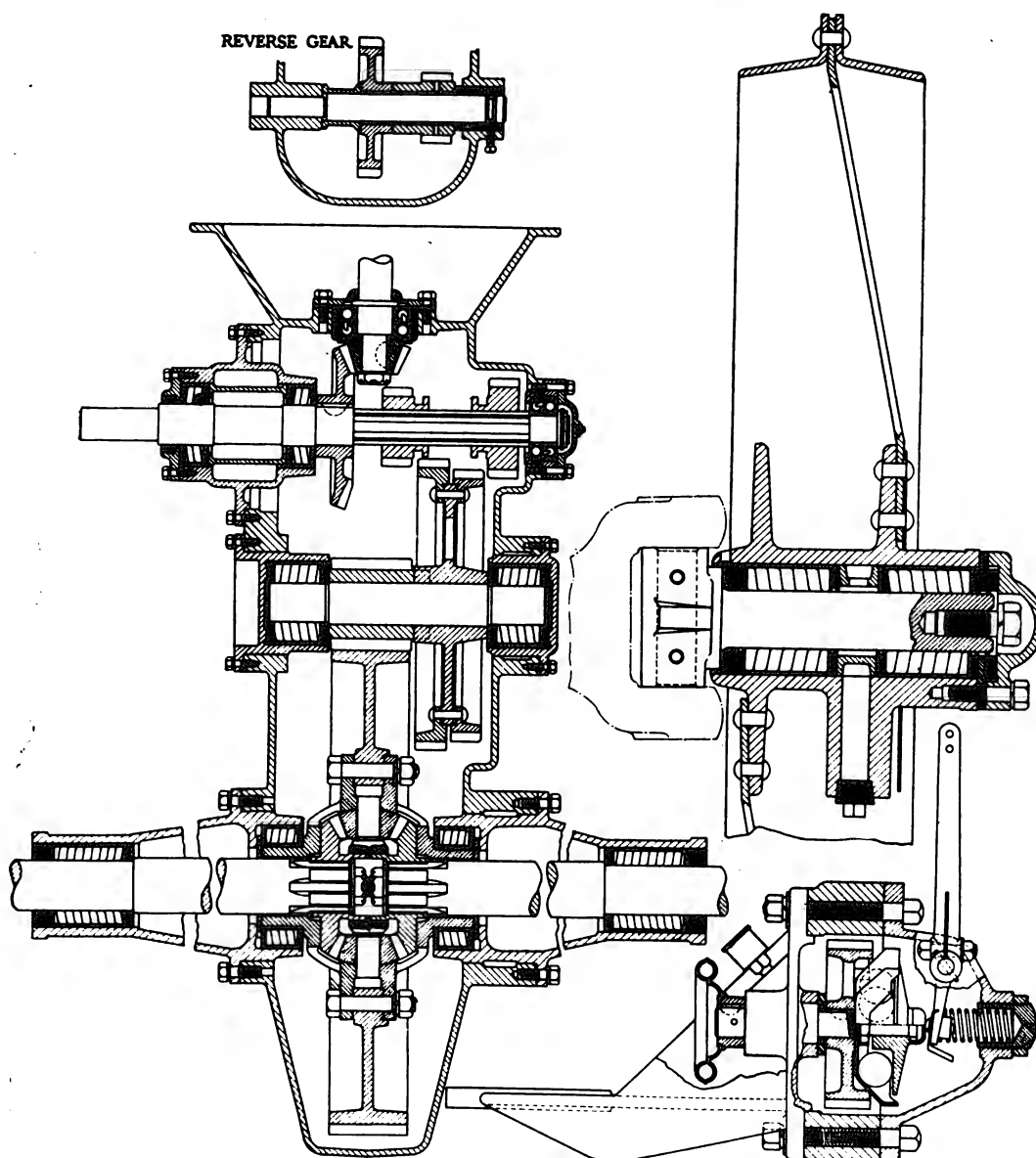
An air cleaner of the wet type is furnished, which was specially designed for this particular tractor. The necessity for frequent carbureter adjustments is said to have



Samson Model M tractor



Longitudinal section through tractor



On left—Horizontal section through transmission and rear axle. On right above—Section through front axle, showing roller bearing mounting. On right below—Section through engine governor

been eliminated. Particular interest attaches to the manner in which the heat of the exhaust gases is utilized for vaporizing the commercial kerosene used as fuel. A combined exhaust and intake manifold is provided, the construction being such that at the will of the operator all or only a small part of the exhaust gases can be passed over the surfaces enclosing the intake passage. The control device by which this is effected comprises a pair of manually operated butterfly valves. A single carbureter, adjusted to operate in conjunction with the heat control system, serves to meter and spray the liquid fuel. Gasoline carried in a small compartment of the large fuel tank is used for starting. After a few minutes' operation, sufficient to heat up the walls of the intake passages, kerosene is admitted to the carbureter by means of a three-way valve. By the same movement of the operator's hand the gasoline is automatically shut off, and the operation continues with kerosene. Gasoline may also be used as operating fuel, all that is required to that end being a slight adjustment of the carbureter needle valve.

The governor is of the centrifugal type and is entirely enclosed. The flyball unit is driven by a spider which is combined with the magneto drive gear. Adjustment

over a range of speeds from 900 to 1500 r.p.m. is accomplished by means of an adjusting screw in the front of the governor housing. The governor lever is direct connected to the inlet throttle, the lever and connecting link being the only exposed parts.

A high tension magneto is standard ignition equipment, and a fine-toothed adjustable coupling is furnished. An impulse coupling is offered as an extra.

A cast bell housing unites the powerplant with the transmission, enclosing the flywheel and clutch unit. The latter is of the multiple disk type, steel on steel, and runs in a bath of oil supplied automatically from the engine base. The clutch disks are made of saw-blade steel. The operating thrust is absorbed by the pinion bearing mounted in the forward end of the transmission, thereby relieving the crankshaft of any thrust duty from that source. Operation of the clutch is by a conveniently located pedal. No means for adjustment of the clutch are provided, but the clutch action is said to be smooth and positive.

The transmission is a spur gear type, with an initial reduction from the clutch shaft to the splined

shaft through a pair of coarse pitch spiral bevel gears. Sliding gears on the splined shaft mesh with corresponding gears on the countershaft, and the final reduction is by a 12-tooth pinion meshing with a 72-tooth bull gear. The differential is of the conventional bevel gear type. Two forward speeds, of 2.3 and 3.2 m.p.h., respectively, and a reverse speed of 1.06 m.p.h. are secured at normal engine speed. A selective type of gear-shift with guide plate makes possible the selection of the desired speed.

The bull pinion is cut from alloy steel and is heat-treated to stand severe duty. The bull gear is cut from semi-steel. Being symmetrical, it can be reversed on the differential housing, thus presenting a new working face on the teeth. All other gears are cut from carbon steel and oil-hardened, as are all the shafts.

The clutch shaft and one end of the splined shaft are mounted on high duty ball bearings. All other shafts are carried on high duty roller bearings running directly on hardened and ground journals.

All gears, shafts and bearings are enclosed in a dust proof, oil tight, cast iron case, the bottom half of which may be removed for inspection or repairs to the mechanism therein. The gears operate in a bath of heavy steam

cylinder oil. The splined shaft passes through the left-hand side of the case and carries on its outer end a belt pulley of 18 in. diameter and 6-in. face. This supplies power for belt work of practically any nature.

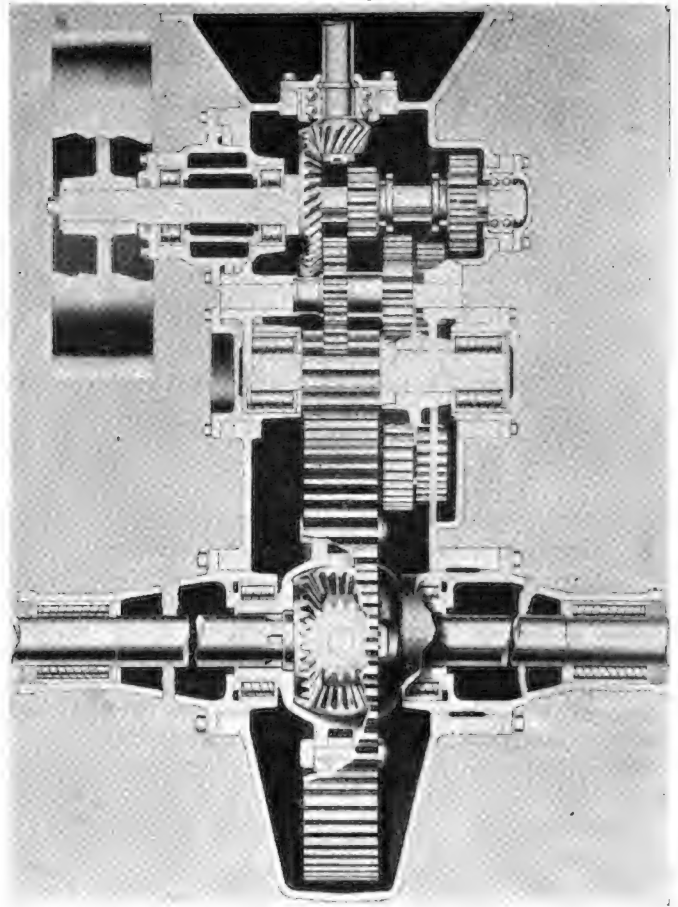
To opposite sides of the transmission case, at the bull-gear center, are bolted cast axle arms in which are carried the wheel shafts and their bearings.

Both front and rear wheels are of rolled and stamped steel construction, fabricated and riveted. Hubs are cast and machined for bearings and shaft fits. The front wheels are carried on drop forged steering knuckles, case hardened and ground. The rear wheels are 45 in. in diameter, have a 12-in. face and are provided with twenty-eight $2 \times 2\frac{1}{2}$ -in. angle cleats. Special rice field and sand equipments are furnished as extras where required.

The front axle is a malleable iron casting of I-section and is pivoted at the center to permit travel over rough or uneven ground. Radius rods pivoted at the flywheel housing transmit the thrust of the tractor wheels to the front axle. Cushioned connection relieves the operator to a certain extent of undue shocks when negotiating rough or stony ground.

Among other recent improvements has been the replacement of plain bearing front wheels by wheels of the same general design, but fitted with roller bearings. These latter are fully enclosed and protected from dust and dirt. Heavy oil lubricating means are provided and the volume of oil carried in the bearing chamber is said to be ample for several months' constant operation.

The wheel bearings operate on case-hardened and ground spindles, and side thrust of the wheel is taken on a plain thrust washer, which is inserted between the end of the hub and the hub cap. The thrust bearing surface is thus located where it is protected against dirt and can be thoroughly lubricated.



Half-tone view of Samson transmission in section

New Running Board Construction

A GOOD example of sheet metal panelling and the disposal of tool boxes and baggage grips so that they do not form accessories hung on to the car, is presented in a new model designed by the d'Ieteren Body Building Company of Brussels and built on a 6-cylinder Fiat chassis. The two spare wheels are set in a well on the rear panel, the edge of the wheel being flush with the panel.



Running board to carry tool boxes and suit cases

The running boards are made use of to carry tool boxes and suit cases. There are really two running boards, the bottom one being at the usual height and the upper one flush with the floor of the car, the space between the two forming a locker into which specially designed tool boxes and suit cases are fitted. The face of the locker is hinged, thus giving a very neat appearance and allowing the cases to be pulled out as required. This arrangement gives complete protection with great accessibility. The running board locker is very neatly run into the domed front fender, with a battery box built into the base of the fender. The car is fitted with a concealed top.

Des Moines Leads in Home Ownership

THE Division of Building and Housing of the Bureau of Standards has recently completed a chart showing graphically the percentage of home ownership in 1920 in cities of the United States having a population of over 100,000. This chart is based on statistics compiled by the Bureau of Census and also includes a table giving the same values as the chart and in addition the percentage of ownership in the years 1910 and 1900.

In 1920, the lowest percentage of ownership in the country was in New York City, having 1,278,341 homes of which 12.7 per cent were owned by the occupants. At the other end of the list is Des Moines, Iowa, with 31,644 homes of which 51.1 per cent are owned.

How One Observer Views the Garden Tractor

A large market foreseen, but considerable diversity in types to meet varying service conditions is considered necessary. The mounting of implements is discussed, and some statistics regarding production are given.

By Fred C. Ziesenheim

TO complete the motorization of the farm, the small tractor has been evolved to replace single horse and hand operated implements in the preparation of the soil and in planting and cultivating row crops. The small tractor is the newest important development in motorized farm equipment.

The potential market for the small tractor is seemingly tremendous in that it can be used on every farm, irrespective of size, down to the small garden patch.

There are over 6,500,000 farms in the United States. About 2,673,000 of them are of approximately 100 acres and nearly 1,000,000 are of less than 20 acres. More than one-half of the total area devoted to all crops is devoted to crops requiring cultivation. The peak load in hours of horse labor on the average farm comes during the cultivation period and not in plowing and fitting the soil, which is work that the present type of large tractor is designed to do. Large farms devoted to general farming have, in addition to row crops, vegetable gardens and large lawns. Thousands of acres are devoted to specialized farming like that of cotton in the South, onions in the Mississippi Valley, beets in the Middle West and West, and tobacco in the Middle Eastern States.

The market gardener near the cities needs the small tractor to complete the motorization of his farm since he uses a motor truck, instead of horses, to carry his produce to the city markets. Usually, he does not grow his horse feed but purchases it. With motor trucks and good roads, the market gardener is not forced to locate near his market on high priced land, but can locate at a distance where land values are lower. Larger acreage can be purchased, which, through the use of motorized equipment, will give greater returns on the investment. Florists and nurserymen operate under conditions similar to that of the market gardener, and they have been quick to realize the advantages of the small tractor.

Specialized farming and market gardening require considerably less investment and are much more profitable than general farming. Intensive farming will come about as a natural sequence to an increasing population. If the relative increase in population of city over country continues at the same rate as during the past decade—and there is every reason to believe that it will—those remaining on the farm must increase their production of food-stuffs by the greater use of improved power farming machinery.

Markets for the garden tractor in addition to that of the farms are the innumerable greens such as golf courses, parks, cemeteries and large estates where a power lawn mower can be used, since a power lawn mower can be easily attached to the small tractor. There are millions of homes with a lawn and garden patch where the small

tractor will lighten the menial task of pushing the lawn mower and the garden cultivator.

The lower operating costs of small tractors, as compared with that of horse-drawn implements, are attributable to factors similar to those which make the large tractor more economical. The tractor makes possible a greater productivity per man hour; there are no operating expenses when the machine is idle, it consumes fuel only when it is working. A machine does not have to be humored on a hot day but will work at full capacity. In cultivating row crops, there is no loss from horses nipping or stepping on plants. A comparison of costs with that of hand-operated implements is evidence that a motor cultivator makes it possible for a man to do more work than when he has to supply the motive power himself. Man power is the most expensive form of power. The greater utility and flexibility of the small tractor is an advantage in that it can do one-horse tasks, hand cultivator work, push a lawn mower, and it can also do a variety of belt work.

A 9-in. plow is the minimum width of moldboard plow that will satisfactorily turn a furrow and plow deep enough to give a good seed bed. A narrower moldboard plow cannot turn under and cover up the crop remains, weeds, loose material or whatever else is on the surface of the ground. The engine power required to pull a 9-in. moldboard plow set at a depth of 5 to 8 in. and at a reasonable rate of speed, will be approximately 5 hp. The tractor must have sufficient weight and wheels wide enough to secure positive traction. The wheels must have sufficient tread and the center of gravity of the tractor must be low enough that in plowing with one wheel in the furrow, the tractor will not tip over readily. Plowing on side hills aggravates the tipping condition. The conditions imposed on the plowing type require that it be a heavy, powerful machine with large wheels set at a considerable tread.

The garden tractor can be divided into plowing and non-plowing types. The functions of a plow are fourfold in that it must turn over the soil to present a clean surface for planting the new crop; it must bury the remains of the previous crop; it must plow sufficiently deep to bring to the surface subsoil that has not lost as much of its plant food as the surface soil, and it must, during the plowing operation, break up and pulverize the soil so that the amount of fitting required in the preparation of the seed bed shall be a minimum.

The tractors which cannot pull a 9-in. moldboard plow should be definitely designed and marketed as a non-plowing type, until such time as some other form of plow is available which will permit narrower furrows. Considerable sales resistance has already been created by unsatisfactory plowing demonstrations. It is difficult enough to

sell farmers any radically new equipment without trying to show them that the machine can do work for which it is manifestly unsuited.

The curved disk type of plow holds possibilities worthy of development in that it can satisfactorily cut and turn over any width of furrow desired. The development and marketing of a satisfactory disk plow would eliminate the non-plowing classification and would greatly increase the utility of the smaller garden tractor.

The plowing type can be divided into the riding and the non-riding types. The riding type has been developed to secure a greater ease and facility in operating the cultivation implements, particularly in eliminating the lifting or carrying of implements in making a turn. To quote a professor of farm engineering: "The day of walking farm machinery is past. Modern power farming equipment sets too severe a pace to require that the operator tramp after the machine. The operator must conserve his energy so that he may give his undivided attention to the implements and the tractor." Implement manufacturers have recently developed riding cultivation equipment which is adaptable to many of the present types of walking garden tractors.

The manner of attaching implements to the tractor depends upon the size and class of the tractor and the type of implements used. In present designs, the implements are attached at the rear of the tractor proper. The cen-

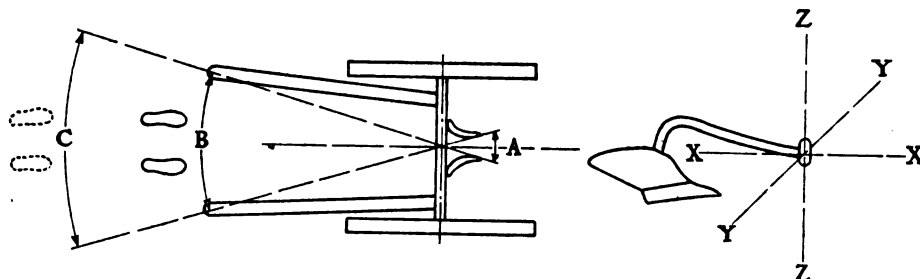
so that it is possible to cultivate closer to the plants and to make shorter turns.

In cultivating row crops by straddling, the tractor must have considerable clearance from the ground to avoid pushing over the plants, but the tractor's center of gravity must be kept low to prevent the tractor from becoming top heavy and tipping over easily. Cultivating two or more rows at a time is possible only when the planting has been done by a multiple row seeder with fixed center distances of the rows. A number of these seeders have been developed for use with garden tractors.

The depth at which the implements operate is varied by raising or lowering the point of draft attachment by means of a lever within easy reach of the operator, thus changing the relative height of implements and wheels. Provision is usually made for lifting and holding the implements entirely clear of the ground when turning around at the end of the row.

The center distance of the two traction wheels can usually be adjusted for different treads and provision is made for fitting on extension rims. In one design the extension rims are very heavy and are used to secure additional traction for plowing. The wheels can be mounted on live axles or can be driven through gearing, chain, or belt. Steering may be accomplished in a number of different ways; steering with the handles, operating with independent clutches in each drive wheel, and on the rid-

Fig. 1—With implements in front, the operator can walk closer to the axle; the handles are shorter and need be swung through a shorter arc for a change in direction of the tractor. Fig. 2—A garden tractor plow has freedom of movement about the YY and ZZ axes, but is fixed about the XX axis to prevent rolling



ter of gravity of the tractor itself is usually forward of the axle center line in order to counteract the torque reaction. The torque reaction, however, assists in keeping the implements imbedded.

A proposed method of attachment for small tractors is to place the cultivation implements in front of the tractor where there is an unrestricted view of the row crop being cultivated, since it is desired to have the implements cultivate close to the plants on each side of the row. With the implements suspended in front, shorter handles can be used, the operator walks nearer the axle center line, the tractor's maneuvering ability is thus increased by lessening the arc through which the handles must be swung for a given change of angular direction. With reference to Fig. 1; for a change in direction of the tractor, the arc on B is considerably less than a similar one on C when using longer handles.

In the plowing type, implements other than plows are attached so that their center of draft coincides with that of the tractor, the point of attachment being preferably on a vertical line equidistant between the traction wheels and passing through the axle center line but located below it so as to counteract the torque reaction. The engine and transmission assembly, however, usually dictate the location of the draft attachment. The implements are set as closely as possible to the center line of the traction wheels so that the radius from this center line to the implements will be as short as possible, as for instance the radius of the arc A in Fig. 1. This decreases the arc of movement of the implements for slight deviations in the direction of the tractor; it permits the use of shorter handles and increases the maneuverability of the tractor

ing type by changing the direction of the caster wheels either through foot bars or a hand operated steering wheel.

Plow Mounting

The center line of draft of a plow is not parallel to the line of movement of the tractor, but is at a slight angle, so that the plow is held into or against the land. The point of attachment should be at the center of tractor draft, as previously mentioned. However, with one traction wheel in the furrow, the location of both tractor and plow is fixed, hence the point of draft attachment must be that compromise which will give the minimum side draft.

Referring to Fig. 2, the plow is fixed so that it cannot turn or roll about the horizontal axis XX, XX being the direction of plowing. When in the plowing position, the plow sets square and level and it can not roll, but must cut a smooth vertical surface for the land side of the furrow. If the tractor plows with one wheel in the furrow, an adjustment should be provided for changing the plow's vertical setting, so that in plowing the first furrow with both traction wheels level and on the land, the plow can be set to cut a square furrow. On the next round, with one wheel in the furrow, the adjustment can then be changed to bring the plow back into the level position.

The plow has freedom of movement about the horizontal axis YY, at right angles to the direction of plowing. The draft attachment floats about a pin in the YY axis, the plow thus seeks its own depth, depending upon the height of draw bar attachment. The height can be varied to give different depths of furrow and for removing the plow from

the ground. If it is possible to vary the height of hitch while running, the plow on starting can be set to reach full depth in a very short distance.

The plow has freedom of movement about the vertical axis *ZZ* in order to seek its own width of furrow, depending upon the transverse location of the point of draw bar attachment. This point can be varied along a line parallel to the axle center line, thus giving a means of controlling the width of furrow turned over.

Plowing with one traction wheel in the furrow tips the small tractor considerably; if the wheel on the land strikes an obstruction, the tractor may tip over. In one design this tipping condition is obviated by lowering the wheel in the furrow relative to the other one so that the tractor is maintained level. The wheels can thus secure full width, flat contact with the ground, insuring maximum traction.

There are about twenty firms making garden tractors in the United States; some have been in business for eight years, but the majority have been in but the last four years. According to bulletins of the United States Department of Agriculture, there were sold during 1919 about 3760 tractors of 6 hp. and less rating. In 1920 six firms manufactured 7678 tractors of 8 hp. and less rating, their total value being \$2,091,000. The total output of all tractors during 1920 was 203,207 machines with a total value of \$193,563,000.

About 15 per cent of the country's total tractor output is exported. The number of gas tractor engines exported slightly exceeds that of the tractor, the total volume of engine exports amounting to \$22,000,000 during 1920. The export possibilities of the small tractor and of their engines appears better than for the larger machines, inasmuch as there are practically no European firms making garden tractors.

Practically all garden tractor firms purchase standard implements from established implement manufacturers, but only 28 per cent of them purchase engines for assembly, probably because there are a number of makes of standard implements available, whereas there are only a few engines which can be adapted to the service.

The tremendous development in automobile production during the past 10 years is due to a certain extent to the fact that a large percentage of the cars marketed have been assembled from standard parts. Over 3 per cent of the passenger car firms purchase engines for assembly. The motor truck industry is a more recent development and has made a greater use of standard parts. Of the 139 manufacturers of large tractors 73 per cent purchase engines and other parts. The garden tractor industry will undoubtedly develop along similar lines when suitable engines and parts are available for assembly.

Many of the firms assembling and marketing large tractors may expect to meet with considerable sales resistance for the next few years. These firms have produc-

tion and sales organizations established, and since implements can be secured from several sources, when suitable engines and parts are available, they will be enabled to market a garden tractor, as it will not require a large investment to enter the business, and the smaller cheaper tractor will not meet with as great a sales resistance.

The small tractor is not strictly a general purpose machine, as it can be designed to meet only a limited class of service. This condition will lead to the development of particular types of small tractors for specific purposes. Many of the small tractors thus developed cannot hope to achieve national distribution, for there will not be a national demand for their particular class of machine. It will follow, then, that small companies will develop tractors suitable for the conditions in their immediate territory, as for instance in the onion growing district of the Mississippi Valley. These firms will not have the resources, nor will they desire, to undertake the development and manufacture of engines, implements and major parts. Their function will consist in assembling standard parts and developing a tractor which is suitable for their conditions. In comparison with the large tractor, the small tractor will require a much smaller investment for development and for the establishment of a limited production and sales organization. Many small firms can thus enter the garden tractor business if the principal burden of development and manufacture is assumed by the parts maker.

The Marketing of Garden Tractors

The retail marketing of garden tractors has usually been through the same channels as that of small cultivation implements. The implement dealer may have a seed and feed, a hardware or a general implement store, or in smaller communities, a combination of all three. Some automotive sales companies have added the garden tractor to their line, which includes passenger cars, trucks, large tractors, and, in some cases, home lighting sets, small gasoline engines and the like. The latter firms can be called power farming equipment dealers and are, from an engine service standpoint, the logical dealers for the garden tractor in the larger centers of distribution. However, the successful application of the garden tractor to the individual requirements of the prospective user requires an intimate practical knowledge of farming implements not possessed by the usual automotive equipment dealer. The garden tractor must be demonstrated and sold on what it can do and not on what the buyer and salesman would like to have it do.

When both manufacturers and dealers have acquired a more thorough and complete knowledge of the capabilities and limitations of garden tractors; have ascertained its particular sphere of usefulness; and have determined to sell them strictly on a performance basis, then the industry will be ready to realize on its potential market.

A New Model of Light Truck

THE Service Motor Truck Co. has added to its line a smaller and lighter speed truck to be known as Model 12. This is of $\frac{3}{4}$ ton capacity and is considerably smaller than the Model 15 described in AUTOMOTIVE INDUSTRIES issue of Feb. 3, 1921. The latter was originally rated at $\frac{3}{4}$ -1 ton capacity, but has since been strengthened in some respects and fitted with larger tires and is now rated $1\frac{1}{4}$ tons.

The new model is, however, similar in general design to the older one. It has, for example, the characteristic three-point suspension of the frame made possible by the special design of front axle and cross spring pivoted to the

frame at its center. It is equipped with a $3\frac{1}{4} \times 4\frac{1}{2}$ in. Midwest engine which develops 32 hp. at 2000 r.p.m., single dry plate clutch, three-speed gearset, tubular propeller shaft with metal universal and slip joint at front and fabric joint at rear, Timken spiral bevel axle with both sets of brake inside the drums, Ross steering gear, pressed steel frame of $\frac{1}{8}$ in. stock $5\frac{7}{8}$ in. deep with 3 in. flange heavily reinforced at cross member at front end of rear springs. The latter are of semi-elliptic type and take both drive and torque. The gear ratio is 6 1/9 to 1, with $5\frac{1}{2}$ to 1 or $6\frac{7}{8}$ to 1 optional. The wheelbase is 128 in. and the tread $56\frac{1}{2}$ in. Chassis weight is given as 2720 lb.

A System for Complete Fuel Gasification

Involves the use of several elements including a device for the mechanical agitation of the mixture, a retort for heating the entire charge above the vaporization temperature of the least volatile elements and means for admixture of small quantities of exhaust gas to prevent detonation.

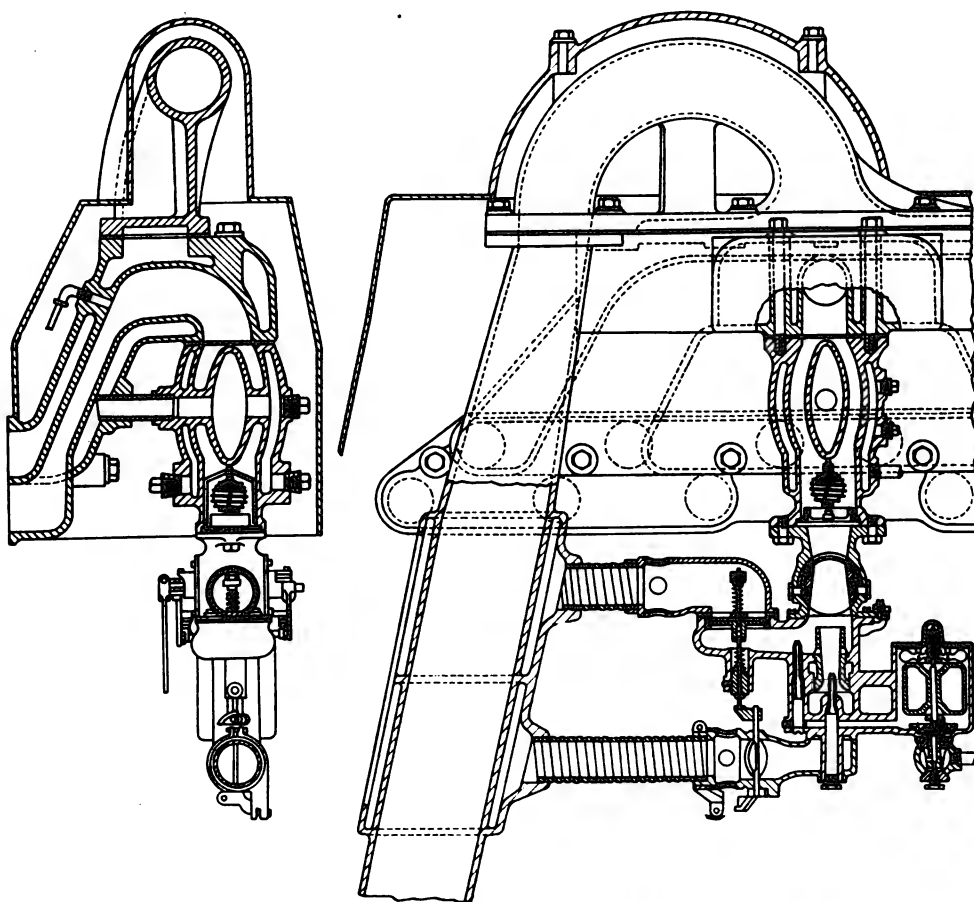
THE fuel charge preparation or fuel gasifying and mixing system invented by Wm. P. Deppé has been before the public for some years. The system now embodies a number of elements added as a result of experience in its use. We understand that the Deppé system is now furnished on a stock engine of well-known make, if desired.

The aim pursued in the system is to so handle the mixture of fuel and air that when it enters the combustion chamber it is in the form of a dry, superheated, homogeneous gas. In order to accomplish this sufficient heat is supplied to raise the entire mixture to a temperature above the boiling temperature of the least volatile fraction of the fuel. In the case of the average American gasoline this is about 425 deg. F. To heat the fuel the liquid particles of the charge are brought into direct contact with surfaces subjected to the exhaust heat. Preignition must be prevented, and as there is not a very wide margin between the volatilization temperature of the least volatile fraction and the ignition temperature of the most easily ignitable fraction, the rate of flame propagation, which affects the tendency to knock, is lowered by the injection of a small amount of burned exhaust gas into the incoming stream of fresh charge.

The apparatus of the Deppé system is inserted between the carbureter and the engine valve ports. In an experimental car built to demonstrate the system in its latest form, use is made of a Stromberg carbureter, and this is also shown in the drawings herewith. Both of the air inlets, the primary and secondary, are connected to air heaters of conventional type cast onto the exhaust pipe, so that only hot air enters the carbureter. The principal part of the system is the charge heater or retort, which is located above the throttle valve. It is quite common to provide a part of the inlet manifold with an exhaust jacket or hot spot, but Deppé goes one step further and makes the riser in the form of an annular passage of comparatively small radial depth, both the inside and outside walls of which are exhaust-heated. The exhaust

gases first enter the central heating chamber of elliptical section and then pass to the outer jacket from which they are exhausted to the atmosphere. Deppé argues that when heat is applied to the walls of a cylindrical inlet pipe, owing to the high speed of the charge through the inlet passage and to its relatively low heat conductivity, only the outer layer of the stream will be heated and the fuel particles carried by the central part of the stream will remain unvaporized. With the arrangement used by him, not only is the area of the surface from which heat can be absorbed increased, but the depth to which the heat must penetrate the gas stream from the heating surface is greatly reduced.

The retort is a separate member, connected to the top outlet of the carbureter and the inlet of the combined inlet and exhaust manifold. The manifold also is designed with flat section inlet passages at certain points surrounded by the exhaust passages. At other points the inlet passages are of a fuller form. The variation



Transverse and longitudinal sections of Deppé dry superheated gas system



External view of engine to which Deppé system is fitted

in the form of the section naturally tends toward increased turbulence and to bring all of the charge into contact with the hot walls successively.

One of the causes of deposition of fuel in the passage above the carbureter is the throttle valve. The ordinary butterfly valve when partly closed deflects unvaporized

particles in the charge against the wall of the inlet passage, to which they adhere. To overcome this difficulty Deppé has devised a special form of throttle located above the carbureter. This, as shown in section in the illustration, comprises two shutters which move toward the center of the inlet passage from opposite sides so that the opening through the throttle valve is always central.

In the lower part of the retort there is located a revolving agitator made up of a helicoidal structure of copper wire mounted on bearings carried by cross bars in the inlet passage.

In order to prevent knocking of the engine, small quantities of exhaust gas are admitted to the inlet passage at three points—on the side toward the carbureter of the two air heaters, on the exhaust pipe, and at the top of the central heating chamber of the retort. In the wall of the lower air heater chamber there are two small drill holes through the exhaust pipe wall, in the wall of the upper air heater chamber there is one, and in the wall of the retort there are five. The admixture of a certain amount of spent gases with the new charge is said to materially raise the compression at which knocking begins and higher compression ratios than with the ordinary manifold construction are said to be practical without water injection to reduce the rate of pressure increase.

An Electrical Primer

THE design of the Master Electrical Primer has been changed so that there are no live wires under the hood of the car, except when the primer is actually in operation—a period of approximately 7 sec. The switch on the dash now makes electrical contact and at the same time opens the vapor outlet to the manifold, making the operation, it is said, as safe from fire as the horn or ignition. Other refinements have been made which cause the electrical resistance coil to produce within 4 sec. a lighter and dryer vapor.

The primer is an electrically heated vaporizer acting as a kind of auxiliary carbureter designed to assist starting, especially in cold weather. It takes the gaso-

line direct from the carbureter, vaporizes it by drawing it over a red hot electric coil and discharges the vapor into the manifold.

It is operated by pulling a button on the dashboard. Contact having been made and the needle valve drawn into its seat by the same movement, the suction of the motor is applied to the inner chamber of the primer. Releasing the button automatically breaks connection.

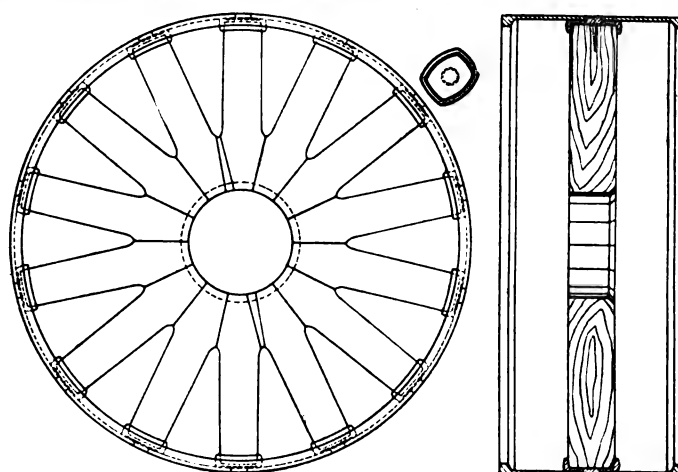
The valve needle is made of monel metal and the resistance coil is made of Nichrome alloy. The heating coil requires 24 amp. The primer is standard equipment on the Franklin, National, Cunningham and some other cars.

A Steel Felloe Wood Spoke Truck Wheel

A NEW design of motor truck wheel which weighs materially less than the conventional wood wheel is being manufactured by Hoopes Bro. & Darlington and has been adopted as standard equipment by one prominent truck manufacturer. As will be seen from the drawing herewith, the wood spokes are retained but no wood felloe is used. The inverted channel section takes the place of an S.A.E. band as well as that of the wood felloe. The manufacturers claim that the spoke has a complete bearing of the end grain on metal. The weakest point of the wood wheel, the seating of the spoke shoulder in the felloe, is done away with. It was at this point that practically all failures of wood wheels originated.

By retaining the wood spokes, the manufacturers assert, they maintain the shock absorbing possibilities of wood, and the new construction adds strength due to the feature described.

The new wheel weighs from 25 to 30 per cent less than the regular wood wheel.



New type truck wheel

Improvements in Gear-box Design

This article discusses gear-box design in detail. It points out some of the usual defects and outlines methods of improvement. The author tells how he would eliminate the bad qualities of the gear box.

By H. F. L. Orcutt*

WHILE it has been demonstrated that accurate gears are necessary for quiet running, it has also been proved that even with quiet-running gears satisfactory results are often quite impossible on account of defective design or workmanship on other components of the box. Certain defects are common to all gear-boxes. They vary in degree, and it is doubtful if any maker of motor cars would say that he is perfectly satisfied with his transmission box. These defects may be roughly summarized as follows: (1) Design; (2) workmanship; (3) material.

Rigidity and Stability of Casings

The design of gear mountings has been the subject of special attention from those who make use of gear-tooth transmission where comparatively high speeds and heavy loads are necessary. It has been found that unless specially designed bearings and adequately stiff shafts are used, gear troubles are common. Undoubtedly, in many designs of motor car gear-boxes the troubles experienced are due largely to lack of rigidity. The box itself is often shaved down to the smallest dimensions. In nearly all cars it is made of aluminum, a metal easily twisted, deflected, expanded or contracted. It is also well known that aluminum has little elasticity and easily "sets" in almost any position into which it may be forced. Further, it has little stability and often changes shape to a degree that is enough to throw bearings out of line. It is doubtful if there is a motor car gear-box made with a casing which has the full theoretical rigidity called for by the loads passing through it.

Size of Shafts

It is really astonishing (especially in some of the so-called "light cars") to note the design of the gear-box shafts. Even in some of the larger cars the tendency is to employ shafts of too small a section. The designer is influenced too much by the desire to reduce weight. Shafts certainly must be large enough so that they will not spring under load. Repeated experience shows that boxes with rigid shafts are quieter than those with small shafts, with gear teeth of the same quality in each case.

Design of Shaft Bearings

The desire to reduce weight and retain simplicity has been carried to the extreme in nearly all gear-boxes. This remark applied especially to one feature of design—that is, the position and number of the shaft bearings. Theoretically, bearings should be so located as to support the shafts directly against the gears taking the load. In practice, with but rare exceptions, gears taking the heaviest loads are in the middle of the shafts and as far removed from the bearings as they can be. Unless

the shafts are of large diameter and the box castings rigid, bad running is easily explainable. The alternative to central bearings is a design in which the shafts are as short as possible and of as large diameter as they can be, and run in a rigid casing.

Ball and roller bearings have been the subject of much research and study on the part of makers. They can easily be selected with proper load capacity. Roller bearings have much to commend them. They are not easily deflected by end thrust if shafts are properly mounted, but adequate end-thrust bearings should be provided. There is no reason why properly proportioned plain bearings should not be satisfactory, provided that the material is carefully selected with good wearing qualities, such as steel shafts running in bronze bushes. The designer, too, must foresee possible renewals, and give special attention to lubrication. The tendency to make the pilot bearing of the main shaft run in a bronze bush in the constant-mesh pinion shaft is correct. Makers of ball bearings advocate a more extensive use of ball-thrust bearings, and they give sound advice in respect to mounting their bearings in the casing, so that they will run with no chance of distortion or undesirable end pressures.

Reverse Gears

There seems to be no good reason for mounting reverse gears of the ordinary design on ball bearings, since proper plain bearings meet every requirement. They are also probably cheaper than ball bearings, as no specially close work is called for in making or assembling reverse gearing. In some gear-boxes reverse gears run in constant mesh. If quiet running is desired, such gears must have the same accuracy of tooth, finish and mounting as the so-called constant-mesh gears.

Forms of Shafts

In respect to splined shafts, there are now comparatively few who adhere to the practice of seating gears on the tops of the keys. The development of special hole-grinding machines in which the holes in gears can be finished at a comparatively low cost, and within fine limits, has helped to establish the practice, now common, of mounting the gears on the cylindrical surface between the keys of the splined shaft. Good practice should leave a considerable space between the top of the keys and the bottom of the splines in the gears; hence only rough machining is necessary on the tops of the shaft keys. The bottom cylindrical surfaces and the sides of the keys of splined shafts are now so accurately machined that gears can be made to run just as truly on a four- or six-splined shaft as if they were mounted on accurately ground plain cylindrical shafts.

The assembling of the sliding gears on the main shaft should be done with no fitting work whatever. Splined

*Condensed from a paper read before the Institution of Automobile Engineers.

lay-shafts are also so accurately machined that fixed gears can be assembled on them with a light push fit with no fitting or hand work. When the proper order of machine operations is followed and correct limits are adhered to, the assembling of gears or splined shafts should be an unskilled operation. A suggested order of operations is given under the description of the process of gear-tooth grinding.

Extreme accuracy in finish-machining splined shafts has been a necessary accompaniment to accurate gear-tooth finishing, as a gear with accurate tooth surfaces will not run quietly unless it runs truly. When a gear is mounted on the top of splines it is extremely difficult to finish the bottom of gear key-ways to a degree of accuracy that will insure true running. When the gear is mounted on the cylindrical bottoms of a splined shaft, every mechanical operation necessary to true running can be done at a comparatively low cost, with no hand work and low assembling costs.

Every possible precaution should be taken to fix details of design so as to reduce possible errors of workmanship to the minimum. Following this principle, it would seem that a four-splined shaft is the best form. In the main shaft with four splines, the circular portions between the keys give large wearing surfaces for the sliding gears, and the keys have ample driving strength for the heaviest loads. In the lay-shaft the surfaces give a good seating for the fixed gears.

Tool equipment (especially the expensive broaches) is simplified if both lay-shaft and main shaft have the same diameter and keys. Cheap production costs are easier to maintain if the broaches are finished with small indexing errors and the widths of the broach splines are kept within small limits. As before mentioned, splined shafts should be of as large diameter as possible to assist rigidity. The square shaft is now employed by very few makers on account of the difficulties of mounting a gear accurately on such a shaft.

Design of Gears

The requirements in the design of gears are pretty nearly the same for both sliding and fixed gears. The length of the hub of the sliding gear is often on the small side. The length of the bearing surface should not be much less than the radius of the gear. These gears should slide freely, and have sufficient bearing on the shaft so that the teeth will always mesh in correct alignment. Fixed gears should seat accurately on the lay-shaft and be locked up dead true. To prevent possible deflection it is best to provide for finishing the ends of the hubs on lay-shaft gears true with the holes. If this is done, the gears on the lay-shaft can be mounted with practically the same clearance as those on the main shaft.

The following observations on gears are based on an experience of over eight years, devoted wholly to gear-tooth grinding of transmission-box gears, after they are hardened. They are made with due humility, realizing that the subject of gear-tooth forms is a big one, and much still has to be learned.

With but very few exceptions, makers of gear-boxes blame the gear-teeth for nearly all their transmission troubles. This is largely due to a lack of understanding of the extreme accuracy in gear-tooth forms that is necessary for quiet running, and the natural corollary that a badly mounted gear with perfect teeth cannot run with good tooth contact. Designers and producers do not usually co-operate in taking every possible precaution that gears run dead true under load. They do not realize that the cheapest box is one in which quality above all should be safeguarded by good design, and

that accurate machine work is the only cheap method of producing uniform results. Gears carefully mounted running at correct center distance, when quiet show contact over the whole working surface and straight across the teeth.

A 20-deg. pressure angle seems to meet general requirements. The pitch should not be too fine; there should be a sufficient number of teeth in all gears to avoid undercut and interference, and the gear-tooth section should be large enough to carry its load. To secure good wearing qualities, tooth widths should be ample; they are usually too narrow. It seems easier to secure good running qualities with the full depth tooth rather than with the stub tooth.

Without altering ratios to any appreciable extent, the variety of gears in a box could often be reduced. Two or more could be made with the same number of teeth, which would make savings in machine setting, in tooling and in inspection.

The making of so-called "cluster" gears—that is, two or more gears in one forging—or the making of a gear integral with a shaft are both questionable practice. Careful investigation will show that economy and good results are in favor of each gear being a separate forging, as making renewals cheaper and producing less scrap. In the case of a gear integral with a shaft, costs of material and machining are increased, and good heat-treatment is made difficult, since the correct treatment for the gear may be quite different from that required for the shaft.

Workmanship

The workmanship necessary to produce a gear-box at a low cost that will run quietly and be of uniform quality is not commonly understood. Too little attention is given to accurate machine operations, and too much is left for the fitter, the assembler and the tester, while limits of errors and clearances are not properly fixed and inspection is not well organized. A well-designed gear-box should be produced with practically no hand work, and it should be assembled by unskilled labor. Dismantling and reassembling, "running in" of gears or "stoning" teeth is uncalled for, and there should be no extraordinary scrap.

These statements apply to all gear-boxes, either the low-grade article where quiet running is not expected or the high-grade box where quiet, smooth running is demanded.

All mechanical operations on gear-box parts can be carried out to a limit of accuracy that should call for no corrections on the fitter's bench. These limits, as they apply to boxes where good running qualities are expected, will be briefly stated.

Casings

In the casing itself the bores for the main and lay-shaft bearings should not have an alignment error exceeding 0.001 in. in 12 in. The center distances should not have a variation exceeding 0.001 in. Where ball bearings are to be used, the limits of error in the sizes of the holes should be those laid down by the makers of the ball bearings, which, by the way, are usually not adhered to. Scraping out bores should be avoided. Forcing and hammering in bearings easily produces distortion in the soft metal housings, with all sorts of unsatisfactory and expensive results, and a variety of noises that defy classification. It would probably be well to have all casings inspected immediately preceding assembling.

Splined shafts should be finish-machined with no error exceeding 0.001 in. in length, widths and indexing of

keys, or on circular portions. The cylindrical parts can be easily ground to fit correctly in either bushes or ball races. It is hardly credible, but it is true, that many makers seem to have little appreciation of the necessity for careful, accurate centering of splined shafts. They do not seem to know that accurate grinding cannot be done when parts are revolved on inaccurate centers.

The following limits for grinding the holes in gears and on the circular surfaces of splined shafts give satisfactory results. They can be easily adhered to, and with proper inspection no fitting work should be necessary between the gear and the splined shafts.

The maximum clearance between the splines in the gears and the sides of the keys on the shafts depends on the accuracy of the broaching, and the accuracy with which the holes in the gears are ground in relation to the splines. As stated, the variation in size of the keys on shafts in length, thickness and indexing can be kept within 0.001 in.

HOLES IN SLIDING GEARS AND FOR MAIN SHAFTS FROM 1½ IN. TO 2 IN. DIAMETER

	In.
Limit for hole grinding	0.001
From minus 0.001 in. to standard.	
Limit for shaft grinding on circular surfaces.....	0.001
From minus 0.002 in. to minus 0.003 in.	
These limits give:	
Maximum clearance of	0.003
Minimum clearance of	0.001

HOLES IN FIXED GEARS AND FOR LAY SHAFTS FROM 1½ IN. TO 2 IN. DIAMETER

	In.
Limit for hole grinding	0.001
From minus 0.001 in. to standard.	
Limit for shaft grinding on circular surfaces.....	0.001
From minus 0.001 in. to minus 0.002 in.	
These limits give:	
Maximum clearance of	0.002
Minimum clearance of	0.000

To avoid fitting work, the maximum width of the shaft keys must be such that there will be no interference on the sides of the keys when the splines in the gears have their maximum errors. To assist in keeping these errors within workable limits, it is suggested that the splines in the gears be finished by a short, specially made broach to be used for finishing only. This broach should remove the smallest possible amount of stock, and the pilot should fit the finish-ground hole in the gear. It should be finish-ground after hardening to standard size, with no errors in indexing or lengths and widths of keys exceeding 0.005 in. This broach can, of course, only be used, as suggested, when the splines in gears are left soft.

The amount of play between the keys on the shafts and the splines in gears can easily be kept to less than 0.001 in. on both main and lay shafts. Alignment of holes in gears in relation to splines can be maintained if the fixture shown in Fig. 1 is used.

Gears

The following notes refer to gears which have their teeth finished after hardening or heat-treating, and which either slide or are fixed on splined shafts, seating on the bottom cylindrical part of the shafts. The bottom of the splines in the gears should clear the top of shaft keys from 0.005 in. to 0.010 in. The top of the shaft key is only rough-turned to coarse limits. The sides of the keys on the shafts are ground to the degree of accuracy already mentioned.

The holes in the gears should be ground true with the splines, using a fixture similar to the one illustrated in Fig. 1, and though no care need be taken to finish the holes true with the teeth, the ends of the hubs of the gears should be finish-ground true with the holes. The

variation in diameter of holes should not be more than 0.001 in.

To give good running qualities the mating gears should show a good hand-roll on fixed centers, and the teeth

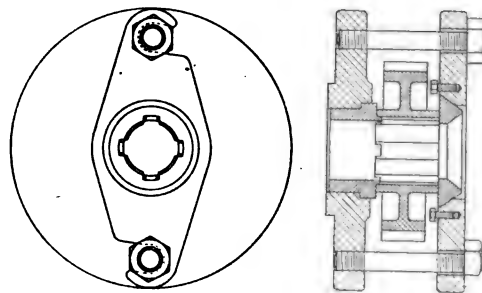


Fig. 1

should show contact over the full working surface from top to bottom of tooth and straight along the full width.

As it has been pretty well demonstrated that complete tooth contact is desirable, it naturally follows that the teeth of gears should be as nearly as possible of correct theoretical form—if an involute tooth, a pure involute—and the finish of the tooth surface should be as smooth as possible. Indexing errors should not exist; they probably do, however, to a certain extent occur in all gears, but unless so small as to be difficult to detect, noisy running will result.

Backlash

The minimum backlash should be such that the gears when under duty will run freely when the box is made with the maximum allowable errors in all its components. Properly mounted gears with correct tooth forms run quietly without regard to backlash as long as they can run freely.

Practicable working backlash limits can vary from a minimum of 0.006 in. to a maximum of 0.010 in. Inspection should be made with mating gears mounted on close-fitting perfectly parallel fixed studs, set at exact center distances, with feelers inserted between the teeth which are in contact.

Eccentricity can be tolerated to a certain extent without bad results, but should be held to fine limits, say a maximum of 0.002 in.

Materials for Castings, Shafts and Gears

Aluminum gear-box castings have one virtue, they are light in weight. But with this metal it is difficult to secure two essentials to good running, namely, stability and rigidity. It is a question whether the gear-box casting of the future will not be made of cast iron, provided that the weight would not be increased too much. Covers and bushings certainly will be made of aluminum. For gears a 5 per cent nickel case-hardening steel has been found most satisfactory. Gears made of this steel, with ample tooth surfaces and properly heat-treated, have been run for years in transmission boxes with no sign of "pitting" and showing only the slightest wear. For splined shafts a 0.15 per cent carbon case-hardening steel meets the requirements.

Future Developments

Will the gearbox of the more or less standard pattern as in the majority of cars, be the gearbox of the future? As at present made, it will probably not survive the exacting demands of the motorist, who is now accustomed to refinements in engine construction, good steering gear and smooth-working back axles. The author believes that it is possible to evolve a much better box than that now commonly made, making use of the principles that

have been demonstrated by years of experience to be good. Broadly speaking, the weaknesses of the usual gearbox are twofold, the design and the workmanship. The design is one in which stability and rigidity are difficult to realize, two qualities which are indispensable to satisfactory running.

The author believes that experiments would demonstrate that in a gearbox of which the case is made of aluminum, success will be difficult. Probably a considerable amount of development work will be necessary before a casing will be evolved in which accurately finished and accurately mounted gears will give good results.

In respect to workmanship, it must be admitted that bad workmanship is the rule and not the exception. This should be corrected for several reasons. In the first place, the costs of production in nearly all boxes would be reduced, as accurate machine work combined with good inspection is very often cheaper than hand-work. The quality of most gearboxes would be improved by increased accuracy in mechanical operations.

How many gearbox makers know exactly what they have done to a defective box which finally passes the test? Gears distorted by heat-treatment are "run in." Often the teeth are "stoned." Boxes are mounted in the chassis and given a road test, condemned, dismounted and the gears perhaps "stoned" again or scrapped and replaced. Finally the box passes test. Who can say what has been done to cure the evils or exactly what was the original error? Scrap is made and costs are run up time after time, and the process is repeated, not in every car made, but in many, and in some cases many times on one car.

Gear Box Noises

Uncertain costs are tolerated and quiet running on all speeds is usually given up as a hopeless task. The box finally passes the tester with no exact knowledge of what the original defects were, nor how they were remedied.

Not infrequently a gearbox that is noisy in one chassis runs fairly well or even quietly in another. It seems reasonable to conclude from this fact that defects in other parts of the car made themselves manifest in the gearbox. This is undoubtedly the fact. Gearbox noises have been stopped when an imperfectly balanced engine has been corrected, when couplings have been altered, and when propeller shafts have been increased in size or more firmly supported. If boxes were uniformly produced with all their components made within correctly specified limits, undoubtedly defects in other car units which are now often hidden in irregular gearbox workmanship would be more easily located.

Good design may be defeated by bad workmanship; indifferent design may be moderately successful backed by superior workmanship. Fully satisfactory results are impossible unless designer and producer co-operate, which they rarely do. Details of design should not be settled without consulting those responsible for production. Advice from the production staff should be freely volunteered to the engineering officials. Before a satisfactory box is produced much development work must be done, though the difficulties to be overcome are not formidable when compared with those which have been mastered either in the engine or the axle drive. Probably the standard type of gearbox in its broad principles is worth retaining.

The following are suggested as items which should receive special consideration in experimental or test work, with the object of evolving an improved design of gearbox:

1. The selection of proper material for gears and shafts, with correct specifications of heat-treatment.

2. The design and material of the casing to be such as to give the rigidity and stability necessary to maintain good running conditions.

3. The determination of dimensions of components, including gear teeth, to meet full theoretical requirements of loads and speeds.

4. The correct specification of limits of accuracy of machine operations on all parts.

5. A careful study of the methods of production of parts so that designs lend themselves to machine operations by which low costs, accurate finish and correct mounting are possible.

6. The making of power tests of the box under load at all speeds, independently of chassis tests.

7. Tests in the chassis on the road to determine how running is affected by other units or by the method of mounting.

Gear-Tooth Requirements

It will probably interest those who wish to give the subject of gearbox development special attention, to have as much information as possible respecting gear-tooth requirements. It is quite natural that there should be a wide divergence of opinion respecting a gear-tooth specification for transmission-box gears. Most motor car gears are either finished after heat-treatment with cutters which must necessarily rapidly wear out of truth, or they are hardened after machining and either "run in" or "stoned." Each of these processes results in the production of gears of which the teeth are not of uniform dimensions. It is difficult to form a definite opinion of an article in which the most important dimensions are of an irregular nature.

It is not generally known that gear-tooth forms where quietness, high speed and high duty are called for, must have errors much less than those which are usually allowed in the finest cylindrical grinding. The errors must be so small that they are pretty well impossible to control commercially with any cutting tool except the grinding wheel, whether the teeth be soft or hard. Gear-tooth surfaces, being irregular curves, are difficult to measure, and the final test is made by running under load with theoretically correct mounting.

Gears which are of known uniformity and quiet running should pass the following inspection:

1. Satisfactory hand-roll of mating gears at fixed center-distances.

2. Power tests for noise at high speeds with mating gears accurately mounted at fixed standard center-distances.

3. Backlash so that gears run freely without jamming. Backlash need not be to fine limits when tooth forms are correct.

4. Eccentricity must be within fine limits. It should not be more than 0.002 in. in any gear in the ordinary transmission box.

5. Index errors (by which is meant the pitch spacing of the working faces) must be such that they cannot be detected under ordinary methods of inspection.

6. Tooth shapes must be as near standard as possible, showing on hand-roll or on power test with the mating gear a bearing over the whole working surfaces of the teeth.

7. The finish must be smooth. A roughly finished tooth is not as quiet as a smooth one.

Gears in which the teeth meet the above specifications should run quietly, though the box in which they are mounted may be noisy, but if it is, the symptoms should not be mistaken for the disease.

(To be continued)

A Discussion of Present Methods of Fuel Vaporization

How one engineer views the problems of preparing fuel-air mixtures for combustion prior to admission to the cylinder. A satisfactory system must include means for giving good pulverization and correct mixture proportions and provide separate heating for unvaporized parts of charge.

By N. Julien Thompson

WITHIN the last decade and particularly within the last three years, gasoline has shown greater proportions of high boiling point constituents, and both the initial and final boiling points have been raised. To assist in vaporization two principal methods have been used, one consisting of heat application to the intake-air supply, and the other involving the use of an exhaust heated surface or "hot spot" so arranged that the wet mixture from the carbureter will impinge on the hot surface.

As ordinarily applied neither method gives completely satisfactory results. The principal disadvantage of heating the intake-air to the point required to give a "dry" mixture is the unfavorable effect upon volumetric efficiency and engine power. Unless thorough vaporization is secured, we cannot employ mixtures as lean as desired and still obtain good performance on account of the fact that it is very difficult, if not impossible, to design an inlet manifold for engines having four or more cylinders which will give perfect distribution in the case of wet mixtures. If we try to use such a wet mixture we find that one or more cylinders will give evidence of "popping back" on sudden power demand while the others may fire quite regularly.

According to tests by Kegerreis* on a Knight engine at half load and 1000 r.p.m. in the case of a mixture producing a good compromise between power and economy, namely, 0.07 lb. gasoline per lb. of dry air, an intake-air temperature of about 280 deg. Fahr. was required to give an absolutely dry mixture, but smooth performance could be obtained at points above 160 deg. Fahr. It is extremely doubtful, however, in the case of sudden acceleration under load, that a good cylinder power balance would result at this temperature and mixture ratio. In fact, Kegerreis advocates a warmer mixture to eliminate oil dilution, which indicates that one cylinder at least is receiving a mixture so wet that it is not dried by admixture with the residual exhaust gases from the preceding cycle.

According to Kegerreis the mixture temperature corresponding to an intake-air temperature of 160 deg. Fahr. is approximately 116 deg. Fahr. It seems to the writer that the latter is somewhat low. The method used in ascertaining mixture temperature is not mentioned, but if the measurement was made by insertion of a thermometer in the inlet manifold, as was probably the case, then it is certain that the thermometer reading would be low because the thermometer bulb would be wet in a mixture of such low fuel ratio that, under con-

ditions of equilibrium, a dry vapor would result due to the partial pressure of the fuel at the existing manifold vacuum and temperature. Accordingly, the bulb must furnish a considerable portion of the latent heat of evaporation of the wet film which covers it. In cases where the mixture is dry or practically so, measurement by ordinary thermometer should be quite satisfactory.

In some ways the hot spot of the ordinary type is a less desirable expedient than the heated air-intake. It is easy to regulate the air temperature by thermostat and hot-air stove, but close control of the hot spot temperature with relation to the demand is practically impossible. Moreover, a temperature cannot be used high enough to secure thorough vaporization at all times without producing an unduly large temperature rise in the fuel-air mixture as a whole or without danger of ignition in the manifold which occurs at temperatures approximating 550 deg. Fahr. for present low-test gasolines.

As an atomizing or fuel pulverizing device the carbureter nozzle increases in efficiency as does any other nozzle with the velocity of the liquid passing through it. The liquid velocity and, therefore, the fuel pulverization, other things being equal, increases according to the suction applied to the nozzle, or according to throttle opening and engine speed. The greatest amount of heat from the exhaust is available at high speed under full load, or at a time when it is needed the least. To offset this there are, however, two favorable factors: The lower vapor velocity at low engine speeds, which allows more time for vaporization to take place, and, under light loads with a throttled engine, the increased manifold vacuum, the effect of which is virtually equivalent to an increased fuel volatility.

It is helpful to cut down or increase the supply of exhaust heat to the hot spot by means of a valve, the position of which is changed with speed or throttle opening or both, and engines have been designed embodying these features. However, the present-day car user demands flexibility above all things, and, since he gets it, speed and load are so quickly changed under driving conditions that the temperature of the hot spot must show considerable lag behind the exhaust heat valve variations. Accordingly it is desirable to make the hot spot of good conducting metal and as thin as is allowable. A disturbing factor is the formation of sooty carbon on the exhaust side of the surface, thus decreasing the thermal conductivity and hence the efficacy of the device. Carbon in the exhaust system is proof that combustion has not been completed in the cylinders.

While pointing out the limitations of the two methods of vaporization, the writer certainly does not wish to

*AUTOMOTIVE INDUSTRIES, Sept. 29, 1920, page 610.

give the impression that they are to be condemned. On the other hand, operation without these features would have been impossible on recent commercial gasolines. Still, we must look for a decrease in the supply of motor gasoline or a lowering of its grade, and in the latter case, which is the more likely in the near future, it will become more and more difficult to obtain good economy and satisfactory engine performance without marked decreases in power output.

Realizing the failure of the hot spot and heated air-intake methods to fully cope with the vaporization problem, the writer, due to intense personal interest, but not on account of any connection with the automotive industry, studied the various factors involved in the use of low grade gasoline and kerosene. This study and the conclusions drawn therefrom have since been substantiated by the invaluable work of Wilson and Barnard.*

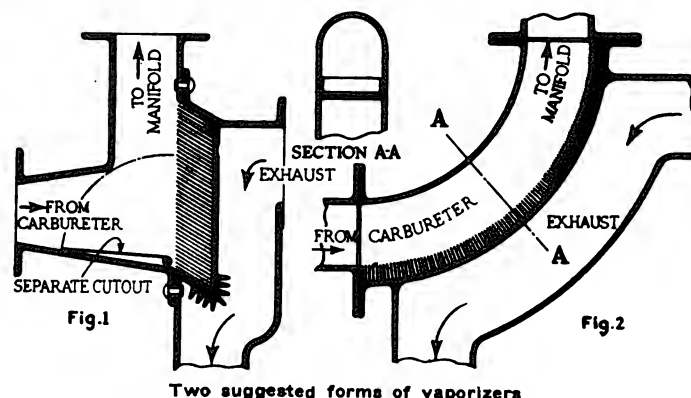
It is desired to thoroughly vaporize the fuel after leaving the carbureter mixed with the requisite proportion of air, the whole assuming a temperature at which manifold condensation cannot occur. Using the figures given by Wilson and Barnard for a typical gasoline of spec. gravity 0.743 (60 deg. Baumé) and having a distillation range from 140 deg. Fahr. to 412 deg. Fahr., it is found that once vaporization is secured no condensation can take place at temperatures in excess of the following:

Vacuum, lbs. per sq. in.	15:1 Air to Gas Ratio, deg. Fahr.	12:1 Air to Gas Ratio, deg. Fahr.
0.0	95	104
3.0	86	94
4.5	81	89
6.0	76	83
7.5	70	77

With these figures and those of Kegerreis we are at once able to draw a comparison between what might be obtained and what actually is obtained when air heating is used to effect vaporization. At a 15 to 1 ratio and assuming a manifold vacuum of at least 2 lb. per sq. inch (for the engine used by Kegerreis) at the prevailing conditions of speed and load, a temperature at 90 deg. Fahr. is required to maintain a dry mixture once secured, but an air supply at 280 deg. Fahr. resulting in a mixture at about 220 deg. Fahr. is necessary to produce a true vapor. By calculation it is found that in the latter case the weight is about 23.5 per cent less for a given charge than in the former. Using the wet mixture figure of 116 deg. Fahr., at which it is claimed smooth operation can be obtained, there is still a decrease in weight of approximately 5 per cent, although it is realized that the temperature of a dry mixture can be lowered to the point where a considerable portion becomes condensed and apparently smooth performance be secured on account of the very fine state of division of fuel particles so produced. The gasolines used by Kegerreis and by Wilson and Barnard are not the same, but a study of their characteristics as given shows that for the purposes of this argument the difference is inconceivable.

The following conclusions were reached with respect to the production of a practically perfect vapor from gasoline-air mixtures:

- 1—Raising the temperature of the intake-air on account of the low thermal conductivity and specific heat of the latter, results in a large decrease in volumetric efficiency. The time for heat interchange is altogether too short, but cannot be materially increased without serious complication.
- 2—The "hot spot," which is also correct in principle,



Two suggested forms of vaporizers

is subject to certain practical limitations, viz.: it is impossible to closely control its temperature; it is exceedingly difficult at high vapor velocities of wide variation to use a hot area sufficiently large for the purpose set forth without producing an unduly great increase in the heat of the mixture over the majority of the operating range.

In spite of the inadequacy of the usual "hot spot" against which the mixture is directed, it is believed that an exhaust heated metal surface will prove the most satisfactory considering the degree and quantity of heat required. However, it is recognized that if a sufficiently large hot area is employed, provision must be made to vaporize the fuel separately or to protect the vapor formed as a result of carburetion from unnecessary rise in temperature. Separate volatilization of the gasoline with subsequent admixture with air involves changes in carbureter design as well as difficulty in starting the engine. Accordingly, means were studied by which use might be made of all the available heat, if necessary, and still leave the carbureted vapor in a cool condition.

From this study it was concluded that a satisfactory system must comprise the following sequence: Efficient atomization of the fuel and admixture with the correct proportion of air by the carbureter, separation of the remaining liquid particles from the vapor stream, directing these liquid particles against an exhaust heated surface where they are volatilized, conducting the resulting gas back to the original vapor stream, the system being so arranged that the final aggregate vapor mixture temperature produced will exceed as little as possible the temperature at which condensation takes place. Means must be provided to facilitate starting with a cold engine. Furthermore, for use to the best advantage, control of the mixture temperature is advisable. This can be obtained by a thermostat placed in the final vapor stream and operating a cold air valve located between the carbureter and an air-heating stove.

Fig. 1 illustrates a device designed to act according to the scheme outlined above. The fine parallel lines represent a nest of thin metal plates or vanes. The liquid particles are thrown on to these and conducted to the heating surface. The plates are sufficiently close together so that the original vapor is protected from the heat, but still not close enough to induce capillary action. To provide for quick starting with a cold engine, the valve or "separator cutout" is designed to be raised by dash control to a vertical position, allowing liquid fuel to pass the separator plates. This device might be used with fuels of lower volatility than present-day gasoline, maintaining a very hot exhaust-heated surface.

In Fig. 2 is depicted a vaporizer which is probably more suitable for use in connection with existing motor

*Journal of Industrial and Engineering Chemistry, Oct., 1921, p. 908.

fuels. Since the hot surface is closer to the mixture conduit, quick response will be made to changing throttle conditions. Moreover, the mixture is deflected more gradually from a rectilinear path, thus depositing the liquid particles over a large proportion of the heating surface. This device does not permit as easy starting from a cold motor as may be desired. However, this difficulty is easily overcome in many ways, e.g., by a by-pass conduit provided with a suitable valve, independent cylinder priming, or an electric resistance heating coil in the path of the mixture as it leaves the carbureter.

It is possible to design a great number of devices

which on casual inspection are not all similar, but which really may embody the same principle. For example, liquid fuel may be thrown out by a bend in the conduit, by a baffle or series of baffles, by centrifugal force, and so on; and the vapor stream may be protected from the heating medium by vanes, baffles, screens and by separated ducts, channels or chambers. Yet each one to be successful must give efficient separation of the liquid, good protection of original vapor from excessive heat rise and effective and quick vaporization of liquid fuel so as to respond almost instantly to changing throttle opening.

Electric Standards Being Formulated

THE Lighting Division of the Society of Automotive Engineers Standards Committee is considering a proposal that the tolerances for the diameters of the standard bases and sockets for headlamp bulbs should be reduced, as it is stated that they are wider than necessary and permit sufficient play to cause considerable variation in the position of the filament and consequently the illumination characteristics of the lamps. It is felt that although narrower limits are not essential, they would improve the specifications and not introduce undue restriction on manufacturers of the parts.

Breaker Contacts

At a recent meeting of the Electrical Equipment Division it was decided to consider the standardization of the hexagon stock used in making timer-distributor contact breakers. It was stated that there is considerable variation in the size of stock for mounting the breaker points, necessitating a number of sizes of wrench for adjusting this part on the several types of ignition apparatus.

It was suggested that $\frac{1}{4}$ -in. hexagon stock be considered for adoption as standard, and that if this is not feasible, the standard should embody a range of two or possibly three sizes, such as $\frac{3}{16}$, $\frac{1}{4}$ and $\frac{5}{16}$ -in. It was argued also that the proposed standard should embody the height of the hexagon and the size and length of the thread. Information on present practice is to be obtained for consideration at the next meeting of the Division.

It was reported that a thorough investigation of the patent situation in connection with spark plug hoods had been made and that it was claimed that a number of patents in the aggregate cover any practical form of construction. It was therefore decided to discontinue consideration of the standardization of spark plug hoods.

Storage Batteries

It has been felt that the Standards Committee could be of service to the storage battery and associated industries in connection with the recent development of a molded hard rubber storage battery container. As the molds and equipment for making these containers are very expensive, it seems that the logical procedure for the battery, automobile and hard rubber manufacturers is to get together and adopt standards relating to the rubber container, before too much money shall have been spent on mold and machine equipment.

A further object of the standardization proposed would be perhaps to guide the automobile builders in adapting their battery compartments to this more compact type of battery, so that they and their customers will not be handicapped in the way they have been handicapped in the past when an automobile was put out with a battery compartment of such dimensions as to preclude the use, for either original equipment or renewal, of any but one special make and type of battery.

Another point is the need of a name to distinguish the single compartment container from the present case and jar. It is stated that the word "container" is not desirable on account of its similarity to the word "retainer" and because it has been used in a general sense already. The words "case," "box," "tray" and "jar" are already used as names of battery parts.

It was decided to take up the standardization of magnet wire for automotive apparatus, including both fabric and enamel insulation types.

Electrical Equipment Nomenclature

The use of the term "timer-distributor" was thoroughly discussed at the Standards Committee Meeting held on May 24, 1921, and several negative votes were cast against the adoption of the term by members of the Society in the July, 1921, Society Letter Ballot on the adoption of standards. The comments submitted were discussed at the meeting of the Electrical Equipment Division and the opinion was expressed that "timer-distributor" is the most suitable term and should be retained. Chairman Libby stated that he had noticed that the term is used in the majority of cases in technical references and in about 80 per cent of the patent investigations that he has conducted, and that these sources indicate that the term is of long standing. It was therefore decided to recommend no change in the present nomenclature.

Generator Mountings

T. L. Lee, chairman of the Generator and Starting Motor Subdivision, reported that, after studying the suggestion to omit the dimensions for the pilot specified in the present standard for generator flange mountings, he did not consider it advisable to do so. The discussion indicated that although one large manufacturer of electrical equipment, which suggested omitting the pilot dimensions, does not use pilots on its equipment, a large number of other manufacturers do. The advantage of retaining the pilot was pointed out and the statement that when a customer orders equipment on which no pilot is desired, it is easy to machine off the pilot.

A suggestion in reference to lengthening the threaded-end of the shaft of the generator bracket molding was discussed at length and the decision reached that a change is not desirable owing to the limited space provided for the couplings, particularly in present engine designs.

The Subdivision was assigned the work of standardizing a strap mounting for generators. This had been suggested by an automobile builder, it being stated that a standard should specify a generator barrel diameter of a sufficient distance along the barrel to give a stable mounting, with tolerances of possibly plus or minus 0.002 in. applying to the diameter. It was also said that a standard should establish certain limits for the concentricity between finished part of barrel and the armature shaft.

A New Crankshaft Balancing Machine

Obviates the need for a preliminary static balance and permits of quickly determining the magnitudes and proper angular positions of correcting moments required to insure accurate dynamic balance.

By P. M. Heldt

IN balancing crankshafts and similar revolving parts by the methods in common use so far, a static balance is first obtained by placing the part on balancing ways and removing weight from the heavy side until it will remain in any position in which it is placed. After this static balance has been obtained there usually remains an unbalanced couple, that is, the part is heavy on one side at one end and on the opposite side at the other end. The axial plane and magnitude of the couple are then determined by means of a rotating balance machine. This couple is eliminated by adding or removing weight in two transverse planes, usually at or near the ends of the revolving part. The static balance could also have been obtained by removing weight in one or the other of these transverse planes, and, therefore, the two operations of statically and dynamically balancing a crankshaft or other revolving part can be combined in a single operation.

A balancing machine which permits of doing away with the necessity for a preliminary static balancing has been developed by the Precision Balancing Machine Co. The machine was invented by Dr. B. L. Newkirk, formerly of the Engineering Department of the University of Minnesota, and was experimentally developed by F. McDonough, president, and Amos F. Moyer, chief engineer, of the Precision Balancing Machine Co. As shown by the illustrations herewith, it consists of a bed on which is supported, by means of two thin vertical spring steel blades, a tubular framework upon which the body to be balanced can be

supported and revolved. The framework is steadied by a horizontal cantilever spring with a scroll at its end.

The stiffness of this spring can be changed by varying its effective length, and there is also a micrometer adjustment between the scroll spring and the outer end of the tubular frame. It will be noted that one end of the crankshaft is located directly over the "knife edge" bearing support of the frame, so any vibration induced in the frame is due to the unbalance at the opposite end.

A special type of headstock is carried by the frame, as are adjustable rollers for supporting the parts to be balanced. If an unbalanced part is placed on the machine and is then rotated, it will set the freely mounted frame in vibration. This frame with any particular part has a natural period of vibration, and if the part is rotated at such a speed that the speed of rotation corresponds to the natural period of the frame with work, even a slight degree of unbalance will cause a comparatively heavy vibration. This speed is referred to as the critical speed. The method of operating the machine is as follows:

Operation of Machine

The crankshaft or other part to be balanced is placed upon the supporting rollers and lightly clamped in a chuck on the face plate. Coupled to the work are the revolving parts of the headstock, which are perfectly balanced. To take a reading, the system is set in rotation at a speed slightly above the natural period or critical speed of the

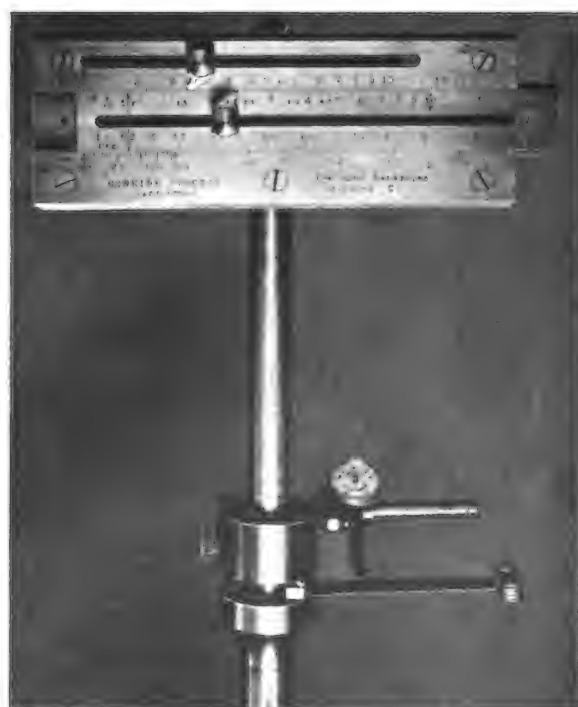
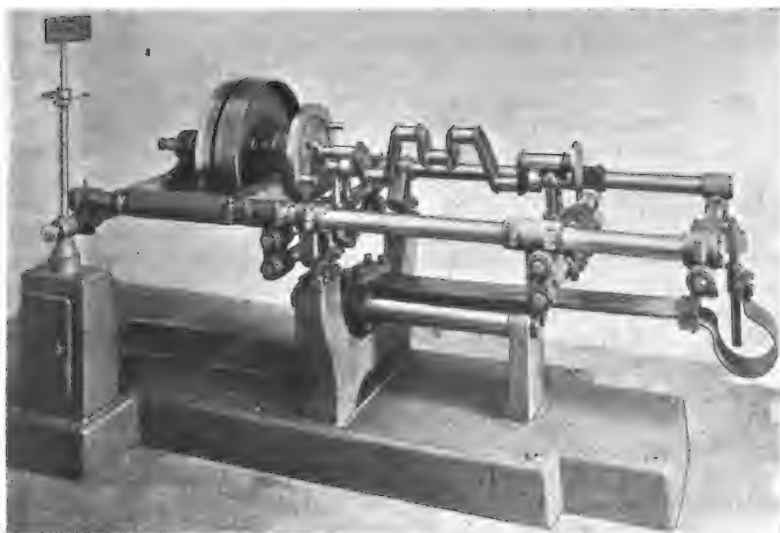


Fig. 1—(Above)—General view of Precision balancing machine. Fig. 2—(On Right)—Instrument column with slide rule for quickly determining angular position of unbalanced moment from negative magnitudes of first and second indications of dial indicator

frame and allowed to slow down by the slight friction of the ball bearings. As the critical speed of the frame is passed through, there will occur a maximum oscillation which is directly proportional to the unbalanced moment of the overhanging end of the part. The maximum amplitude of vibration is read off on a dial mounted on a standard or instrument column, to which connection is made from the vibrating frame by a steel rod or wire. It may be pointed out here that, except when making tests, the frame is held from vibrating by means of a taper plug on this standard, which enters a corresponding hole in the frame. It has been found that the best results are obtained with a critical speed of 100-110 r.p.m. and the cantilever spring is adjusted to give this critical speed. It is quite possible to impart to the revolving system a speed somewhat higher than this by spinning it by hand, but if desired, the headstock can be revolved by a small electric motor.

Magnitude of Unbalanced Moment

From the maximum amplitude of vibration as read off from the indicator and a calibration factor separately determined, the unbalanced moment in ounce-inches can be directly ascertained. A corrective moment is then applied to the rotating system in the form of a sliding weight on the headstock, which is moved out radially from the axis and clamped in position at such a distance from the axis as to give the necessary moment.

To obtain the angular position at which this correction is required, the correcting moment is arbitrarily applied on the headstock at an assumed angle, and the system is again speeded up and allowed to slow down through the critical speed as before. The maximum amplitude this time will differ from that obtained the first time, the ratio of the two readings being dependent upon the angle between the point of arbitrary application and the point required. The trigonometric value of this ratio is

$$R = 2 \cos \frac{1}{2} (180^\circ - A),$$

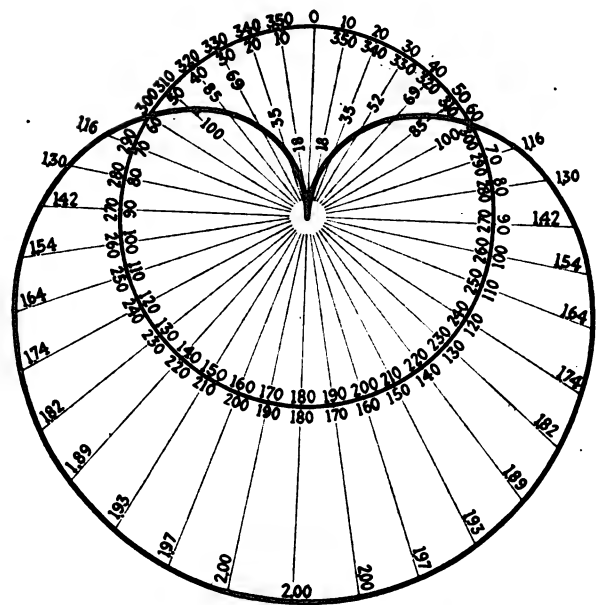
where A is the required angle. This function plotted on a polar diagram is shown in Fig. 3, which may be used for ascertaining the angle after obtaining the ratio of the second amplitude to the first. A scale corresponding to Fig. 3 is also built into a special slide rule mounted on the instrument column. Scales are also here provided for employing the calibration factor and taking ratios, so that the operator is relieved of all computation. The angle ascertained is set off on the headstock dial and the results are checked by another run.

After the magnitude of the unbalanced moment and its angular position have been determined for one end of the revolving part, the latter is turned end for end on the roller supports and a fresh determination is made.

Limits of Precision

For revolving bodies 18 in. or more in length a limit of error of 0.2 oz.-in. is guaranteed, as regards both static and dynamic balance. In the case of short bodies, such as flywheels, the limiting error on static balance is the same, while that on dynamic balance is 1 oz.-in. The degree of accuracy represented by these figures is said to materially exceed commercial requirements. How sensitive the machine is is shown by the fact that although the vibrating frame with work weighs upward of 500 lbs., it can be set to vibrating perceptibly by simply blowing against the free end with the breath. To minimize the friction, the revolving parts are carried on ball bearings.

Parts up to 750 lb. in weight can be handled in the machine, and it is figured that the limit of error in the results obtainable would be sufficiently low for all parts weighing not less than 15 lb., so this constitutes the lower



Automobiles and the Asbestos Industry

About one-half the total amount of money expended for asbestos materials comes from the automotive manufacturer and car user. Use of this product plays an important part in the make-up of many cars. Chemical elements are important and the different qualities mined deserve study.

FROM time immemorial men have known about asbestos, but in the days when it was looked upon as a great curiosity there was probably little thought in the minds of the men of ancient times that some day it would become a factor in the industrial life of the world. Charlemagne, for instance, in all his wisdom and with all his vision, would probably have laughed to scorn the man who told him that the material would some day become an important part of a terrifying machine that ran without any visible power. Charlemagne knew of asbestos as a sort of plaything with which to entertain guests, for he had a table cloth made from it and seemed to enjoy the effect upon his visitors when he threw it into the fire to cleanse it.

And so on down through the ages until something like a half a century ago, asbestos was looked upon as something which had no real purpose in the universal scheme of things.

About 1870, however, it was realized that commercial uses could be made of asbestos. When that fact was finally discovered new uses sprang up almost as fast as the material could be mined, and 40 years later, 1910, hundreds of ways of using it had developed. To-day asbestos mining and manufacturing processes have become so perfected that there are many large mines all over the world, the largest, however, being in Canada. And automobile manufacturers and users spend about one-half the total amount expended for this material.

First Use As Brake Lining

The principal, and probably the first, use to which asbestos was put in the automobile was in the brake lining. This is far from being the only use, however, as every manufacturer knows. The idea of using asbestos in this connection was probably first thought of by a British engineer named Hutchings who conceived its use in 1896. The idea got little further at that time, however, and until 1905 it reposed in the British Patent Gazette, unhonored and unsung. Whether or not C. W. Raymond of Worcester, Mass., who in 1905 was manufacturing parts for automobiles, came across the idea in the British Patent Gazette is not known. At any rate he wrote to a leading asbestos manufacturer about that time and explained that he was having trouble in making a suitable brake lining for automobiles. He had tried mohair, leather and various other materials, but he declared that under high friction caused by weight and speed, these materials would burn and they were not giving satisfaction. The old-fashioned "metal-to-metal" brake had proven unsatisfactory, and some substitute was necessary. He asked the asbestos manufacturer for samples of his product and his opinion as to whether or not the material would prove satisfactory in that capacity. The samples were sent to Mr. Raymond and in a short time patents were taken out and asbestos brake lining, made from a combination of woven asbestos and brass wire, began to be pretty generally used

on motor cars. A recent estimate of the amount of asbestos used for this purpose alone placed the figure at 70,000,000 ft. a year. Of this figure it was estimated that 15,000,000 ft. would be used in new cars, and the remaining 55,000,000 ft. in the replacement market.

As time went on new uses for asbestos in the automobile were brought out, and in the present highly developed motor car there are a dozen or more parts in which asbestos may be used. Perhaps next to brake linings asbestos is used more for clutch facings than in any other part of the car. There are two types of clutch facings, one the woven type, similar to the material used in brake linings, and endless rings are stamped from layers of cloth. The other is the moulded type, which is made from a board of asbestos. Other uses include packing of woven asbestos for gaskets; copper asbestos for manifold, cylinder heads, spark plug washers, etc.; wicks for exhaust pipes; paper and board asbestos around the exhaust pipe for heat insulation; pads for blanketing the radiator; sheets inside the hood and many other uses. Different manufacturers, of course, use the material in different ways, and new devices, some of them novelties, are often placed upon the market.

Most of the asbestos in use in the United States is imported from Canada. True, there are large deposits of serpentine rock, which contains the veins of asbestos, in this country as well as other parts of the world, but development of the Canadian mines has thus far produced the best material. About 75 per cent of the world's supply comes from the dominion. One large mine in Canada, in the province of Quebec, near Thetford, stretches over an area of 500 acres, and about 100 acres are now being worked. Should the remaining 400 acres of this mine be capable of producing the same quality and quantity of asbestos as the first 100 there seems no possibility of a shortage for some time to come. The same company also has a large mine in Arizona, as have other companies and deposits of asbestos are to be found in Vermont. Asbestos is also found in Russia and Rhodesia in large quantities.

Chrysotile, the Commercial Product

There are also large deposits in Corsica and Italy which have not been worked to any considerable extent. The variety from these countries, in part at least, is somewhat different from that produced elsewhere. This product is known as amphibole, and has little or no commercial value. The asbestos most in use commercially is known as chrysotile. Amphibole is to be found in many sections of the United States in large quantities, but the lack of strength of its fibers prevents it being used in a commercial way. Attempts have recently been made to produce a molded material from amphibole, but its success is not assured.

The open pit, or quarry method, is the one most in use in mining asbestos. In order to get one ton of asbestos fibre it is estimated that it is necessary to blast,

mine, convey and put through the mills something like 15 tons of serpentine rock. The asbestos fiber lies in veins in the rock, and after dislodging the rock from its resting place by blasting, men known as "cobbers" go into the pits, where, with a small hammer, they break away the pieces of rock from the long fiber asbestos. This material is then carried to buildings, where it is further cleaned and sorted.

It is impossible, of course, to get all the asbestos by this method, and the balance of the rock that has been loosened by the blast is loaded in cars and conveyed to the mills. Here it is placed in immense crushers which reduce the rock to pieces about the size of a man's fist. It is dried and again crushed into very small particles, after which it is placed on a sieve where the asbestos fiber is separated from the rock. This process, in itself is interesting. The sieve, which is constantly shaking, forces the heavy rock to the bottom, while above it are great tubes through which an air suction system works. This suction draws the asbestos fiber into the tubes and it is here that it makes its final departure from the rock in which it has been embedded for centuries. The fiber is

then divided into three grades, one called long spinning fiber which is used for the manufacture of textiles, and which is probably used together with crude asbestos to a greater extent than any other grade in the automotive industry; a medium length which is used in making asbestos paper, compressed sheet packings and many other materials. The third is a grade commonly used for the manufacture of asbestos cements, etc. The material is then ready to be packed in bags and shipped away to factories, where it is made into the various things that are proving exceedingly useful in industry. Most of these factories are in the United States, as very few finished articles are imported. The United States is the largest importer of asbestos, as well as the country manufacturing processes used for making the most articles from the material.

To describe the various manufacturing processes used for making various articles would require considerable space, for there is a difference in the process for each article. Even to describe them for the various parts of an automobile would require several pages. In the main, however, these processes are divided into three classes. The first is the carding, spinning and weaving of the fiber into various textile forms from which brake linings and packings are made. This process is similar to that employed in the wool and cotton industries. The second is the process of making asbestos paper or felt, and methods similar to ones used in paper mills are in operation. This product is used for roofings, pipe coverings and other insulations. The last main division includes the making of asbestos shingles and boards, a number of packings, electrical insulating materials and brake blocks of high friction value. From all these processes parts are made for the automobile.

As to what is the best material for the various parts used in a motor car, there has been some discussion. Various tests have been made with different materials, and with different grades, and a divergence of opinion has been the result to some extent. The consequence has been that practically every car manufacturer has his own idea on the subject and buys his asbestos ac-

cordingly. Incidentally, asbestos manufacturers also seem to have formulated opinions of their own along this line, and make their products accordingly. The Bureau of Standards has recently been conducting tests with asbestos as it is used in the automobile, particularly with regard to brake linings. It is known that brake linings having a high coefficient of friction are the ones which will stop a car or truck in the shortest distance, but the material of a high coefficient of friction does not possess the lasting and wearing qualities of that with a lower coefficient. Incidentally, the latter will not serve as efficiently. Naturally the Bureau has been working to strike a happy medium and set a standard for this product. Asbestos manufacturers have apparently realized the value of such tests and in some cases they have adopted the method the Bureau is using and conducting their own tests along the same line and making their product conform to the standards they themselves find to be the best for the particular material or product they manufacture. This is probably due to the fact that each manufacturer uses a different grade and he is attempting to discover the best use he can make of that grade.

The results of these Bureau of Standards tests, however, when completed, should give the automotive manufacturer a fairly clear idea as to what sort of material produces the best results and the car manufacturer can judge for himself as to what make is best suited for his particular car. Tests are still being conducted, and their results are not yet fully known. They are being conducted along two lines, however, one a test under severe service conditions and the other a long wear or durability test.

Little has been said so far concerning the use of asbestos for clutch facings. Molded clutch facing has been on the market for something over a year and is used as standard equipment on a few passenger cars and trucks. The process of manufacturing this molded material is a secret and little is known about it except that it is compressed by hydraulic machinery. After compressing the material into the shape desired it is generally ground in order to present a smooth even surface. It is claimed that this molded facing has a higher coefficient of friction and is more durable than the woven type, but experts have expressed the opinion that its results will not prove satisfactory.

The type most in use at present, however, is the woven, or disk clutch. It is estimated that 274,139,000 sq. in. of disk and plate clutch facings will have been used on passenger cars along in 1921. Approximately 40 per cent of the trucks registered use a disk or plate type of clutch, and while it is difficult to give a safe average of the number of square inches of facing used on these trucks, it has been estimated that it would run in the neighborhood of 110,000,000. One process used in the manufacture of woven clutch facings, as well as brake linings, is to weave the asbestos and brass wire into a compact mass and then to impregnate it with a water and oil-proof binder to prevent the absorption of moisture and then to shape it.

While asbestos is not absolutely indispensable to the make-up of a motor car, it has thus far proven itself to be about the most economical and efficient material to be found for the uses to which it is put. There are many manufacturers who consider other materials better for

Principal Uses to Which Asbestos is Put in the Automobile

Brake linings.
Clutch facings.
Fuse parts.
Cylinder head gasket packings.
Manifold gasket packings.
Spark plug gasket packings.
Exhaust pipe coverings.
Insulation tape.
Sound deadening sheets between
muffler shells.

certain parts, and perhaps they are justified in their opinions. In the main, however, they have pretty generally agreed upon the basic parts in which asbestos should be used.

It is certain that the development of the automotive industry has done much to develop the use of asbestos, not only in automobile but in other machinery. Although there has been no concerted movement among asbestos manufacturers to study the automotive industry with a view to increasing the use of their product, it is believed that most of them, individually, have spent considerable time in planning its use in new ways.

Automotive engineers, on the other hand, have apparently paid less attention to the product. Naturally they have spent some time in studying its uses, but a well-informed engineer said recently that there had never been any particular research work done along the lines of determining what grades of asbestos are best suited for different uses. Automotive engineers should remember that there is considerable variance in the chemical formulas of various grades of asbestos. This is true of the grades produced in different countries and different sections. These differences have a material result in the quality of the manufactured article made from them. As a matter of interest, there are shown here in Canada, Arizona and a variety known as crocidolite with the chemical properties of grades of asbestos mined found in Blue Cape, Africa.

Arizona Chrysotile Asbestos

	Per Cent
Magnesium Oxide, MgO.....	41.85
Silica, SiO ₂	41.35
Iron Oxide, FeO.....	0.69
Alumina, Al ₂ O ₃	0.91
Calcium Oxide, Lime, CaO.....	0.07
Water of Constitution, H ₂ O.....	11.96
Water, Hygroscopic, H ₂ O.....	1.38

Crocidolite Blue Cape Asbestos

	Per Cent
Magnesium Oxide, MgO.....	2.3
Silica, SiO ₂	51.1

Iron Oxide, FeO.....	35.8
Soda, Na ₂ O	6.8
Water, H ₂ O	3.9

Canadian Chrysotile Asbestos

	Per Cent
Magnesium Oxide, MgO.....	40.07
Silica, SiO ₂	39.05
Alumina, Al ₂ O ₃	3.67
Iron Oxide, FeO.....	2.41
Water of Constitution, H ₂ O.....	14.48

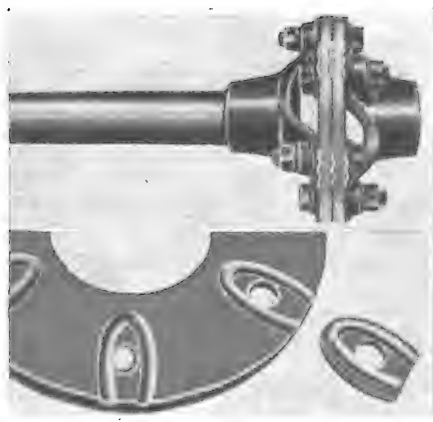
In the manufacture of brake lining it has been found necessary, as well as economical, to use a small admixture of vegetable fibers in order to secure from the asbestos producing machinery an adequate production of a properly fabricated material. The introduction of an excessive amount of this vegetable fiber will inevitably result in a finished brake lining that will give inadequate service, and which in some cases has been responsible for the loss of human life. A maximum percentage in the mixture of asbestos with vegetable fiber is 15 per cent of the latter. Smaller amounts may be used for different weights of cars and it is necessary for the engineer to determine what percentage will be required in the car he is designing. Any greater percentage, however, will burn out readily, leaving a residue of inefficient material which in a comparatively short time must be replaced. Replacement costs amount to many times the difference between the original cost of a good material and the cost of an inferior one.

The automotive engineer should also study the quality and grades of asbestos to be used for other parts of the car. While this has been done to some extent there could undoubtedly be more thought given the question with the result that advantages would accrue to all concerned.

As has been said, asbestos is not indispensable to the make-up of a motor car, but since it has been found an efficient material for the parts in which it is used, its qualities deserve consideration. The part it plays is important and an unsatisfactory automobile can result from the use of poor asbestos.

Improvement in Fabric Universal Joint

LAST summer the Merchant & Evans Co. supplemented its line of metal universal joints by a fabric type known as the Griptite, of which a description and illustration appeared in AUTOMOTIVE INDUSTRIES of July 14. Some changes in design have now been made in the fabric disks of this joint, particularly as regards the holding feature. As shown by the accompanying illustration, a secure driving connection is obtained by



Griptite fabric universal joint

displacing the layers of fabric and rubber from their normal plane while in the vulcanizing mold into substantially radial folds across the surface of the disk, transverse to the line of torque, and gripping these folds with formed steel washers closely fitting this whole folded area. It is claimed that the folding of the fabric, the form of the washers and the close fit of these elements over an ample area without washer ridges or teeth to bite and chew the fabric give the combined effect of lasting tightness of assembly in road use, high torque capacity and great durability.

IN the course of a lecture before the Birmingham Metallurgical Society, E. R. Taylor described an unusual form of trouble which was experienced in the heat treatment of some small engine parts. The right degree of hardness failed to develop, although the composition was quite up to specification. The cause was discovered to be a current of air passing along the bed of the muffle, producing a film of oxidation on the surface of the steel. The matter was remedied by scattering small fragments of charcoal about the size of peas over the bottom of the muffle, the engine parts being put into the muffle on a tray. The charcoal became oxidized instead of the steel, and the trouble was corrected.

Definite Ruling on Heavy Trucks Is Urged

Bureau of Public Roads declares highway engineers must have accurate knowledge as to what loads roadbeds will be expected to support. Heavy trucks should prove their economic value if they are to be permitted to operate. A definite ruling would also materially aid the manufacturer.

THE heavy motor truck is perhaps the most formidable problem confronting the highway engineer of to-day. State and federal officials are at a loss to know how to deal with it. Some state officials are taking what they consider the easiest way out and allowing only certain sized trucks to operate in the state; other states are attempting to build roads that will withstand the assaults of these vehicles. In all cases it is looked upon as a problem. Few persons deny the economic value of the heavy motor truck to the operator, but at the same time many are not convinced that it is of such general value as to warrant expenditure of huge sums for road construction and maintenance so as to allow its operation.

The Bureau of Public Roads of the United States Department of Agriculture, in its annual report, recognizes this condition and suggests either proper regulation of these vehicles, or else restriction of their use to certain highways, built, of course, to carry them. The bureau declares that the problem grows more important each year and is one which, while not to be hastily solved, ultimately must be met squarely and disposed of.

"Whether the operation of the heavier vehicles," says the report, "shall be restricted to a class of roads especially designed to accommodate them, or whether all roads shall be strengthened for unrestricted use, or whether the third alternative shall be adopted and the operation of the heavier trucks prohibited, will depend upon the relation which is found to exist between reduced operating cost and increased cost of construction."

By reduced operating cost the bureau means that reduction that would come from improved highways.

The report goes on to say that there must be a careful weighing of the effects of the several possible solutions with a view to the selection of that one which in the end will accomplish the desired result—improvement in the nation's means of transportation.

Problem Affects All

Such a program would prove of lasting benefit to the automotive industry. The problem is one which affects everyone concerned—the manufacturer, owner and highway engineer. As conditions stand at present the manufacturer is in a more or less uncertain position as to his future program. Obviously, if legislation is to be enacted that will prohibit the operation of vehicles above a certain tonnage prospective truck purchasers will not purchase trucks above that tonnage and it will be useless for the manufacturer to plan for the production of that type. On the other hand, if these vehicles are to be permitted to operate only on specific highways then the manufacturer must learn, as soon as possible, where these highways will be and how many miles of them there are to be. If the unrestricted use of heavy trucks is brought about, and all future highway construction is designed to carry the

heaviest vehicles then the truck manufacturer can be fairly well assured that there will be an increased market for heavy trucks.

Such a solution as the final one is, of course, the most desirable from the standpoint of the manufacturer. It has been proven in many instances that the economic advantages of the heavy truck offsets, by far, the increased cost of highway construction. The bureau report admits that its investigations have proven this in one instance, but "it is not by any means certain that the outcome will be so fortunate under other conditions."

Need for Coordination

It would seem, therefore, that there is need for a great coordinated effort to bring about a solution of this problem. The automotive manufacturer must prove that the heavy motor truck is a factor in the transportation system of the country and its needs must be provided for. Highway construction, it is admitted, is expensive, and is worth while only when it can be shown that the expense is justified. The laws governing truck transportation prove that the truck of greatest capacity is the one that will allow the cheapest unit cost of operation, and still cheaper operation can be secured if proper highway facilities are provided. There is a great deal of logic to be found in the bureau's suggestion that heavy trucks be permitted to operate only upon designated highways. That, however, should hold good only until all the roads of the country are designed to carry these trucks, or at least all the principal roads.

There is the possibility that heavy trucks might never pass over certain stretches of road, even though they were designed to carry them. This is also a problem to be considered in mapping out a national highway program. Varying needs are to be found in different communities, but the thought should also be borne in mind that as better highways are built their use increases. In a certain sense good roads are the result of a demand from owners of automotive equipment, but on the other hand, when good roads are built the use of automotive equipment increases. Consequently, in communities where at present there may be no heavy trucks in operation, the fact that improved roads were built might cause several to be put into operation. Thus highways designed to carry only lighter vehicles, in such localities, might soon be crushed beyond recognition as highways should some individuals decide that better roads warranted their using heavy trucks in their system of transportation. It is this danger that must be overcome in future highway construction.

Whatever the future highway program is to be, however, it is quite obvious that a decision one way or another as soon as possible is desirable. It is believed that a systematic analysis of the problem will prove that the heavy truck has won a place for itself in the country's trans-

portation system. Certainly it has done so in many localities, and if it has not in others the reason has been largely due to the fact that improper highway facilities were afforded.

One important step is now being taken by the bureau, and that is the conducting of tests to determine accurately the load carrying capabilities of various kinds of roads, of various thicknesses upon different kinds of subsoils. This study will yield valuable information in meeting the problems outlined. Comparatively little is known at the present time about what types of road are best suited for

different localities. The fact that two states, having practically the same conditions, adopted radically different methods of highway construction proves that there has been no coordinated effort along this line. An accurate knowledge of these facts would enable engineers to determine the approximate cost of a highway construction program that would permit the unrestricted use of the heavy motor truck. With the knowledge of that cost it would be comparatively easy to show whether or not the economic advantages of the truck warranted the carrying out of such a program.

Brass Forgings a New Industrial Product

FORGINGS of brass and bronze, while relatively new in this country, have been used in Great Britain and on the European continent for a considerable time. A commercial line has, however, been developed by the Mueller Metals Co., at whose plant the commercial application of forged brass has been taken up on a large scale. Some idea of the various units which have been successfully turned out by this process may be gathered from the accompanying illustration of about forty automobile parts of forged brass. Nearly all the parts shown are used on well-known automobiles or trucks.

The tensile strength of brass sand castings are in the neighborhood of 30,000 lb. per sq. in., while the forgings have a strength of 62,000 lb. per sq. in. The forged bars show an elongation of 40 per cent, and break only after considerable reduction in area. The sand-cast test bars show an elongation of only 14 per cent and very little reduction in area.

In manufacturing the forgings, the blanks are heated in an oil furnace and the forgings are made in a 400-ton double-acting press. About 600 impressions are made per hour. There are also single-acting presses



Fig. 2—Micro-photograph of brass sand casting. Tensile strength, 30,000 lbs. per square inch



Fig. 3—Micro-photograph of brass forging. Tensile strength, 62,000 lbs. per square inch

making 900 to 1000 impressions per hour. On small pieces, such as elbows, where several are placed in one die, more than 5000 parts have been produced per hour.

Forgings up to 3 lb. in weight have been successfully produced by this method, and it is expected that new developments will permit of even larger units. It is stated that when necessary, the diameters of cylindrical forgings can be held within limits of plus or minus 0.002 in., but that it is not feasible to hold other dimensions closer than 0.008 in., owing to the variations in the size of the blanks to be forged and consequent springing of the press.

The forging process makes the metal more dense and consequently reduces the chances of porosity. It is claimed that in some instances it is more economical because it is possible to forge close to the finished size and consequently to avoid waste in cutting away a large amount of metal. The metal is also said to be freer cutting.

FROM U. S. A. Ireland imported in 1920, 2,269,000 gal. (British) of gasoline valued at \$544,682 (without duty) and 63,145,087 gal. (British) of mineral oils (kerosene) valued at \$3,420,839, and 2,269,510 gal. (British) of lubricants valued at \$544,628. The value of imported tires and tire parts was £23,834 (\$119,170) from U. S. A.



Fig. 1—A collection of forged brass automobile parts

Buses Major Transportation Medium in Porto Rico

Motor buses are carrying more passenger traffic between the two major cities than the railroads. Trucks extensively used for freight transportation. There are now about 1000 miles of improved roads on the island and extensive highway construction is being carried forward at present.

HUNDREDS of motor buses and several thousand automobiles are in daily use in Porto Rico for the transportation of passengers, and it can be truthfully said that there is no town or village within the island that cannot be reached to-day by automobile. Buses connect the principal cities, the longest line being that from Ponce to San Juan, a distance of 131 kilometers (81 miles), while many others, differing widely in type and size, run between the larger centers and the outlying villages, so many of these lines existing, in fact, that practically all transportation of passengers within the territory is done by automobile.

This expanded use of the automobile is one of the outstanding facts of recent years in Porto Rico. The motor car is no longer considered a vehicle of luxury or pleasure, except by a small part of the population, but, rather, it has become the dependable and customary agent of transportation, performing valuable and necessary services for the island as a whole.

Some months ago a survey of Porto Rico showed a total of about 1000 miles of good roads, and the governmental department in charge of highway work is continually adding to this mileage, in addition to keeping in maintenance the roads already established. The principal highway is the road between San Juan and Ponce, across the island, and there is also a very good macadam road between San Juan and Mayaguez, passing through Arecibo and Aguadilla.

Increase in Buses

Trucks are extensively used, as would be expected, for transporting merchandise to sections, many of which are not connected with the chief centers by railroad. Also, during recent years, a remarkable increase has been made in the operation of trucks converted into passenger buses. These, with their special bodies, seat from 20 to 30 passengers, and new trucks are constantly being put into the passenger-carrying service. One large truck representative, who has been selling from two to three trucks each month for the last year or so, reports that 80 per cent of these vehicles are equipped with bus bodies.

The San Juan-Ponce line runs two buses daily in the regular service from each city, covering the 131 kilometers in from 4½ to 5 hours. Their seating capacity carries 24 passengers comfortably, with light baggage. A large number of smaller cars are in service carrying passengers between other towns all over the island, some of them operating on regular schedules, while others make their trips whenever there are passengers.

The automobile has practically supplanted the railroad for the transportation of passengers between the two chief cities. The railroad is built along the coast,

thus more than doubling the distance of the cross-island road and consequently requiring a much longer time of travel than do the buses. This railroad runs from San Juan to Arecibo, Aguadilla, Mayaguez and Ponce, its distance being 274 kilometers. Another short-line railroad connects San Juan with Caguas, 36 kilometers distant, but it carries few passengers, those making the trip generally preferring to do so by automobile.

Transportation Costs

Both passenger cars and buses leave San Juan daily for Fajardo, Guayama, Juncos, Humacao and other points in the interior. The fares are considered reasonable, despite the cost of gasoline. It is possible, for instance, to hire a six or eight-cylinder car, seating five or seven passengers, for the trip between San Juan and Ponce for from \$16 to \$35, depending upon the make of car.

On the other side of the island from San Juan there is similar motor service from Ponce. Buses leave daily for Yauco, Adjuntas, Guayama and other interior points. From San Juan some 200 light cars and buses are in daily service to carry passengers to and from Rio Piedras and Santurce, the residential suburb of the city. The number of these vehicles increases daily.

The use of automobiles throughout Porto Rico has shown a steadily increasing number during recent years. In December, 1920, an official statement of the Department of the Interior listed 4780 motor vehicles, but in the intervening months this number has so increased that the present total is at least 5500, although some estimates place the total at from 6000 to 7000. However, the smaller number seems the more authentic and is probably a fairly accurate census.

The year 1921 showed a large decrease in the sales of automobiles in Porto Rico, the same as in practically every other country of the world. The automobile dealers, however, are feeling much encouraged at the prospects for the months to come, as sales already have improved materially. The return to normal sales conditions depends, of course, upon the sugar industry, but, according to present indications, business in the island should better itself very much in the near future.

Fiat to Enter Indianapolis Race

FIAT is expected to send two racing cars to Indianapolis next year in charge of Louis Wagner and Pietro Bordino. The Fiats are 183 cubic inch eight-cylinder-in-line engines built for the French Grand Prix of this year, but not ready in time. They have only been raced once, on the Brescia course, Italy, last September, when they established a world's road record, but were beaten by the Ballots over the total distance.



Metallurgist and Engineer

Editor, AUTOMOTIVE INDUSTRIES:

Mr. Pomeroy's letter signed "Foralum," appearing in your issue of Dec. 8, 1921, struck me at first as being little more than a semi-facetious attack upon myself prompted, perhaps, by not unnatural irritation at the fact that I did not agree with Mr. Pomeroy in regard to the desirability of employing castings for frame construction. From that point of view, I should gladly have left the matter to the sense of humor of your readers. Unhappily, however, Mr. Pomeroy raises the issue of "engineer vs. metallurgist," and while I am far from wishing to pose as the representative metallurgist, I must yet decline to accept Mr. Pomeroy as the typical engineer. I have, both personally and professionally, many dealings with engineers, both automotive and others, and always find them very ready to appreciate whatever the metallurgist can do for them. The proper relation between these two closely allied professions should surely be one of mutual help and understanding, and without any trace of such hostility as seems to peep out from Mr. Pomeroy's remarks.

In his first paragraph, Mr. Pomeroy suggests that "the metallurgist" is taking upon himself what "the engineer" dare not do—apparently to suggest the right way of employing new materials of engineering. He follows up this attack by referring to "some of the finest real engineering the world has ever seen" and having been carried out "before the metallurgist was ever heard of." I can only suppose that he is thinking of the Pyramids of Egypt or similar works, but Mr. Pomeroy would hardly regard these as useful examples from the point of view of automotive engineering. Actually, engineering and metallurgy have always progressed together.

Mr. Pomeroy gives away his whole case, such as it is, by demanding that the metallurgist should tell the engineer what test should be applied to ascertain the value of any material. Surely, in so far as the functions of the two can be really separated at all, it is for the engineer to specify his requirements and for the metallurgist to do his best to fulfill them. The engineer is in the best position to ascertain the nature and extent of the stresses which occur in his structures, and when he has told the metallurgist precisely what he requires the metal to resist, then it will be possible for the metallurgist to predict with real certainty what material will withstand the conditions. It is useless for Mr. Pomeroy to demand, vehemently, that the metallurgist should state the value of all materials in terms of the steel "which the engineer knows." How far does the engineer know his steel any better than he could—if he wished to avail himself of the existing data—know some of the newer alloys? One who, like myself, has frequent occasion to examine breakages and failures, soon comes to realize that the engineer, on the whole, cannot be so deeply familiar with the properties even of steel—or, if he is, he sadly neglects that knowledge at times. Here, again, it is essential that engineer and metallurgist should work in harmony and achieve progress together. It is, surely, only a step toward that co-operation for the metallurgist to put forward his views and suggestions for the

utilization of new materials which he has studied, and it is a distinctly retrograde step for any engineer to attack a metallurgist in general terms because he has done so.

The more detailed portions of Mr. Pomeroy's letter are difficult to treat in any limited space. Were I to follow his methods, I should be inclined to refer to the well-worn quotation as to the considerably greater ease of asking questions as compared with answering them. However, some of his points may be dealt with seriatim. Thus, he objects to the attempt to estimate the value of materials for constructional purposes by means of the ordinary mechanical tests—tensile, impact, etc. There is much to be said for that point of view, except this—that as yet there is not only no better way, but no alternative way at all. On the other hand, Mr. Pomeroy evidently has only hazy ideas about the nature of what he calls "stress hysteresis" and fatigue generally. I might, perhaps, refer him to some of my earlier articles in your columns, and would only mention here that the standard "fatigue" tests throw the fullest light on the endurance of metals in that range of stress "before failure commences" in an ordinary tensile test. Mr. Pomeroy says that the engineer wants to know what takes place before failure begins, but what the engineer really needs to know is at what stress or range of stresses failure really will begin—and that the fatigue test can and does tell him. No doubt it is necessary to correlate the indications of all tests with the results of actual service—but that correlation serves to add to the value of the tests and not to eliminate them; also—in the case of new materials, it is not as yet obtainable.

Mr. Pomeroy deals with the piston and his anger is mainly directed against the suggestion that a forging rather than a casting is likely to be "the" piston of the future. In support of his view he instances the troubles of pressed steel pistons, but quite ignores the point that those failures were really the result of wrong design. In the aluminum alloy piston, there is—owing to the lightness of the material—no need to use very thin sections and thus the main difficulty of the thin steel piston disappears. As regards production—in connection with which Mr. Pomeroy brings off his concluding flash of humor—I can only say that evidently production engineers differ a good deal in their views, since the request for the development of aluminum alloy forgings for piston purposes actually came to me from an engineer who wished to avoid the loss, in production, arising from the frequent occurrence of wasters due to unsoundness in the castings with which he had been dealing.

This brings me to the main question of "castings vs. forgings," or wrought material generally, which Mr. Pomeroy raises. And here let me say that I am not by any means speaking from the point of view of the test-piece, but from a very wide experience of actual castings and forgings produced for war and other purposes. Undoubtedly much is to be said for the use of a casting where it can be really rationally applied. In it the metal can be readily brought into the desired place, and—particularly if the engineer ignores the real exigencies of the foundry—castings of delightfully complicated shape can be produced. All this would be quite conclusive, and we might

even regard a cast aluminum-alloy automobile frame as a really reasonable proposition, if two conditions could be fulfilled. The first of these is the production of castings whose actual working strength—say power of resisting shock and fatigue—was comparable with that of wrought material of similar specific gravity, and second, if we could always and uniformly rely upon the complete soundness of the castings. I would suggest, on the basis of the wide experience referred to, that neither is the case. Recent research has produced castings whose tensile strength is not far short of that of the best wrought alloys, but their resistance to fatigue and shock is still decidedly lower. Is it, then, rational to use the cast material in any position where wrought material of equal weight and greater strength can be employed? In the pre-aluminum days, would Mr. Pomeroy have suggested the use of a cast-iron frame for an automobile in preference to wrought and heat-treated steel? Yet this analogy is strictly fair unless we consider the new heat-treated castings, which might perhaps be likened rather to cast steel than to cast iron. In aluminum alloy castings it is never possible to be really sure that invisible defects may not seriously impair the strength, unless the casting is of a particularly favorable shape. Castings required for frame construction, however, if they are to be economical of weight, must necessarily be long and narrow, with comparatively thick lugs attached to them—an ideal combination for producing “drawing” and unsoundness. When the aluminum alloy has first been cast as a simple ingot or slab and has subsequently undergone rolling or forging, coupled with careful inspection, the possibility of serious internal flaws is practically eliminated, so that wrought material is definitely much more reliable than cast. Furthermore, it is not easy to produce castings of the light sections which can be satisfactorily used in wrought material. All these considerations, although they go to show the undesirability of using castings for such a purpose, by no means prove that it cannot be done.

With regard to the question of springs, I am not prepared to enter into a discussion of the theoretical formulæ of the engineer; if Mr. Pomeroy's figures are right, there is not likely to be any great saving in weight by the use of light alloy springs. At the same time, I would still advocate a trial, since the exact effect of a different ratio of density to elastic modulus may bring with it unexpected effects. Furthermore, Mr. Pomeroy's calculation seems to me to apply only to material under uniform stress and to neglect the fact that in a spring of given stiffness, the material might be quite differently distributed if it were aluminum alloy as compared with steel. This may make it possible to utilize the material more efficiently, since it is evident that in any ordinary spring only part of the material—indeed, only a small part—is stressed up to the maximum range which the metal can withstand.

It is evident that the questions raised by Mr. Pomeroy afford room for much discussion, which might be profitable if it were pursued in the true spirit of inquiry and in an effort at closer co-operation between engineer and metallurgist. To any sort of controversy in which they appear as adversaries, however, I think it worse than useless to contribute. In this I feel sure that the broad-minded engineer will agree with me.

WALTER ROSENHAIN.

Steering Creeper Tractors

Editor, AUTOMOTIVE INDUSTRIES:

The article in AUTOMOTIVE INDUSTRIES of Jan. 26, 1922, by Mr. H. C. Oliver on “Steering Track-Laying Vehicles” looks very simple on paper, but I do not believe it to be of practical value.

The power required to turn the worm wheel (13) on the differential (12) is considerable, also its speed for short turning is greater than a hand wheel could be turned conveniently.

The same principle could be worked out by friction disks, but of course the cost and poor efficiency of the scheme prohibits it.

Tractors of to-day and to-morrow must be made of the fewest number of parts that will meet the requirements and come within competition costs.

VICTOR L. DARNELL.

Brake Design and Materials

Editor, AUTOMOTIVE INDUSTRIES:

On page 243 of the February 2 issue of AUTOMOTIVE INDUSTRIES it is stated in connection with “Better Brakes” that “it is next to impossible to provide adequate brakes for long and difficult grades when these alone are depended upon for the necessary retarding effect.”

As you know from former conversations, I am not in accord with this statement, which, I think, is contrary to the proved performances of the best English and European practice.

Brakes can be designed without excessively expensive production which shall be absolutely trustworthy for all uses to which they may be put, in any class of hilly or mountainous country, and it should never be necessary to waste fuel by using the engine as a brake for long distances. Neither should it ever be necessary to descend a hill in a low gear.

Brake materials are now being manufactured which will not burn out, and which do not lose in friction as they grow hot. They are being used on a large number of electric railroads in England and the continent, with a consequent absence of the “flat-wheel” bugbear which curses electric transportation in this country. They are also being used by most producers of good automobiles in Europe and nearly all large omnibus companies. Recent public trials in England have demonstrated that American cars often burn out their brakes, while the local cars do not.

I suggest that it is necessary for the American industry to fully realize how far behind it is in brake design and materials if it is ever to put right this one defective point which militates against its cars all over the world.

I, therefore, suggest the writing of a much stronger article on this subject which shall deal specifically with: (a) The form of brakes, provision for cooling, excluding dirt, etc.; (b) the material of the brake linings, and (c) the correct design of brake actuating mechanism from the lever or pedal to the drum.

MAURICE OLLEY,

Engineer, Rolls-Royce of America, Inc.

TESTS which have been carried out with a system of guiding airplanes in fog by means of the reception of impulses from a ground cable are reported to have yielded satisfactory results. The apparatus, which has been designed by Lieutenant Loth, of the French Navy, will, it is believed, enable regular commercial flights to be made under night and fog conditions which at present render air services impossible. The pilot is able by means of the receivers installed on the machine to ascertain his position with remarkable accuracy, and it is understood that a cable will be laid on a portion of the London-Paris route in the near future. Night flying in clear atmospheric conditions will be assisted by the modification of marine lights to suit the needs of aviators, by landing lights, and by the development of improved navigation lights on the machine.

Car Market Depends on Local Service

The character of the automobile is such that its usefulness is measured by the service it renders. Mr. Tipper stresses the value of giving efficient service and urges retailer and manufacturer to co-operate with service as a goal.

By Harry Tipper

WHEREVER the automotive industry has touched, whether upon production, distribution or finance, it has introduced new elements and revolutionized to some extent the functions previously associated with those departments of business. In the retailing of automotive equipment, the very necessities of the case introduced other functions which were not associated previously with retailing and which separate the business of retailing automobiles from that of any other retail business. This is the first time that any really complicated mechanism has been sold in large quantities to the general public to be used by amateurs or laymen. Wherever complicated machinery has been sold and used in the past it has been subject to the care of experts skilled in the understanding of machinery, the adjustments and the repairs. The automobile is more complicated than many other types of machinery, yet it is sold to people without any technical training and is handled by them without any particular regard to the ordinary care which a skilled operator would expect to give such a piece of machinery.

The automobile is not a piece of merchandise. It is a means of transportation and its usefulness is confined to the extent of the service which it will render continuously. During the experimental period in the development of the automobile, those who were skilled mechanically, or fond of mechanics, attempted to use the new vehicle. When the automobile passed this stage, and became thoroughly useful, the great necessity before the industry was to provide a sufficient number of automobiles to meet the needs of the population. With the present extensive population of cars we are passing into the stable period, where the service rendered by the vehicle becomes of the utmost importance. This service cannot be maintained by the users of the cars themselves without the adjustment repair incident to the use. This adjustment, etc., must be done by the retailer of the car and by other establishments created for this purpose.

The future tendency is for the car market to depend more and more upon the character of the service which is available locally for its continued operation, and less upon the car itself apart from that service. Probably 90 per cent of the people who buy cars in 1922 have owned a car previously. Consequently, they have some background upon which to estimate comparatively the value of the car, and this background is concerned almost entirely with the way in which the car delivered service.

Any complicated piece of machinery requires a certain amount of adjustment, cleaning and other care, no matter how thoroughly it has been built or how carefully it is handled. There is a very much heavier demand for this adjustment, minor repairs and little points of service in connection with the automobile because of the conditions under which it is used and the fact that the owner is not skilled in providing these points of mechanical care. As the car grows older, the repairs become more extensive and the required service larger if it is to be kept in running condition at all times.

In this respect the individual establishments vary in their efficiency more perhaps than in any other respect. The cost of repairing and adjustment, the length of time or actual skill and efficiency of the work vary within very wide limits, so that no car owner can be assured of getting the same character of service in two different localities or securing any reasonable expectation of cost. This problem of the service to be rendered by the retailer is one of the utmost importance to the industry. The market for any particular car in any locality is very seriously affected by the condition of the service available for the operation of that car in that locality, and

THE future tendency is for the car market to depend more and more upon the character of the service which is available locally for its continued operation, and less upon the car itself apart from that service. Probably 90 per cent of the people who buy cars in 1922 have owned a car previously. Consequently, they have some background upon which to estimate comparatively the value of the car and this background is concerned almost entirely with the way in which the car delivered service.

so long as there is such a variation between the character of the work done and the price at which it is to be secured, the use of the car will be limited more than it should be limited.

The growth in the number of automobiles has been somewhat more rapid than the growth in the number of establishments equipped to give the thorough service required to keep the car in condition and to make the ordinary repairs.

Too many establishments in the field do not possess sufficient knowledge either from the mechanical standpoint or from the standpoint of ability to organize, so that the work costs too much and many times it is incorrectly finished. There is a disposition to charge all the traffic will bear in many cases, and to charge a different price for practically the same work in individual cases. A comparison of the cost of conditioning a motor under the same general requirements in four or five different establishments indicates the wide variation in the methods of estimating and the methods of operating on the same job.

To the car owner the retailer who affords reasonably good service represents a reliable authority and his influence upon the whole sales position is in accordance with the authority and expertness exhibited in his work.

No amount of sales work or sales promotion work to the individual owner will offset the influence exerted through the service rendered after the car is sold.

Although the average owner is not mechanically informed, and cannot check up the character of the service from a mechanical standpoint, it is obvious to anyone who watches these conditions that the retailer who is offering excellent service speedily becomes known in his locality and finds his business of servicing extending beyond the cars he may be selling because of the anxiety of the owner to secure reliable service. It is important to the manufacturer of cars that there should be a great improvement in the general average of efficiency in the service rendered and a very much better understanding of the methods to be employed in providing it at a reasonable cost. It has been customary with some manufacturers to work with the retailers for the provision of a standard service as to the cost of parts and the methods of operation, varying only with the cost of labor. It is not enough, however, that some uniformity should be secured in the matter of providing service for the particular make of car, but it is necessary for the retailer to understand the importance of service in connection with the automobile sale and the influence exerted by the character of the service upon the whole progress of the establishment. In this respect, as in other respects, the understanding and ability of the retailer needs to be amplified and developed if the service is to keep pace with the requirements for it and respond to the demands made upon it by the users of the automobile.

In no other problem connected with retailing can the manufacturer be of more benefit, through a close degree of co-operation, than in this matter of the service to be given to the car after it has been sold. The problems met by the manufacturer in experiment and production and the intimate knowledge he possesses as to the detailed construction of the car make it possible for him to co-operate with his retailers very closely in the endeavor to improve the character of the service and take advantage of its influence upon the market. The service to be rendered should be plainly visible in its value to the owner, arranged so that cost can be estimated and

conducted under a fairly standard knowledge of the elements of cost, so that the user will be able to make his comparisons. The character of required service should be studied so that the importance of different elements is determined and arranged for upon a basis which will provide as nearly as possible a minimum of cost for each job.

In this connection it will be necessary for the manufacturer of an automobile to review very carefully the replacement prices demanded for parts required more or less regularly in the servicing of cars and their repair. The cost of manufacturing such parts is naturally higher than the cost of the parts going through the shop on a production schedule, but there exists a wide difference between the prices charged by manufacturers to retailers on parts which are almost similar, and unless the manufacturer is willing to bring his own servicing business into line, it will be futile for him to expect the retailer's service station to operate along standard lines with maximum efficiency. It becomes more and more obvious that service has a great bearing upon the sale of the car. The popularity of certain cars in certain localities can be traced very largely to the character of the service rendered in comparison with others in the same price group. The diversion of buying from one car to another in the same locality is frequently associated with a change in the agency. As the population of cars grows, the future of the whole business is wrapped up more and more in the service rendered in keeping the car in running condition. This is not a problem of the retailer alone—it is the problem of the manufacturer and the retailer to be worked out only in co-operation and with a careful examination of all the factors—the cost of parts, the reasonable time to be devoted to a job, the cost of labor, the allowable variation in the price, the promptitude of the service, the convenience and other matters. These things should have a consideration when the contracts are made between the manufacturer and the retailer or between the distributor and the retailer. They should be a part of the requirements, and the manufacturer should be prepared to do his part of the work in the enabling of service stations to meet these requirements and live up to them.

Specifications for Tires and Tubes

DURING the war the Bureau of Standards undertook an extensive investigation of tires and tubes, with the object of preparing specifications covering such material for military use. This work was highly successful, and as a result numerous branches of the Government adopted the Bureau's specifications.

Circular 115 of the Bureau of Standards, obtainable from the Superintendent of Documents, Washington, consists mainly of a revision of the specifications prepared by the Bureau and now used by the War, Navy, Treasury, and Post Office Departments, the Panama Canal, and General Supply Committee. These specifications were recommended by the United States Interdepartmental Committee on Specification Standardization in June of last year.

A tentative draft of the specifications was submitted to a large number of representatives of the tire industry, including the Rubber Association of America, and in the revision careful consideration was given to their recommendations.

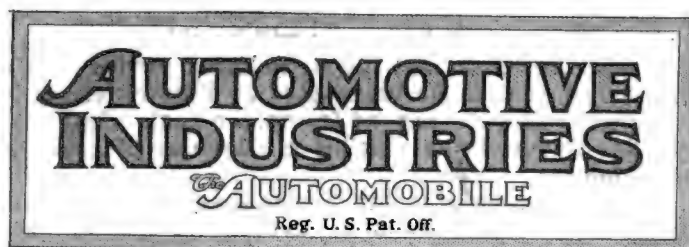
The specifications are divided into three parts—pneumatic tires, solid tires, and inner tubes—and contain a

detailed description of the physical and chemical requirements.

In connection with pneumatic tires, the character and strength of the fabric, the composition of the friction compound, width and weight of the fabric for the breaker strip, the compound from which the cushion is made, and the quality and quantity of the rubber in the tread are carefully considered. The construction of the side walls and the bead, as well as the tire sizes, are likewise specified. A mileage of 6000 and 8000 is required for fabric and cord tires, respectively.

In the case of solid tires, the composition of the tread, its strength and method of fastening to the base band, and the chemical analysis of the base band, together with its tensile strength, are specified.

Analytical and physical requirements are laid down for inner tubes which are divided into three classes—pure gum, red antimony, and compounded tubes—the latter to be used only in 6-in. or larger sizes. In connection with the tubes, minimum diameter, length, thickness, volume of rubber and inflation test for the different sizes of tubes are specified.



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Stable Markets

THE following statement was made before a convention of the National Foreign Trade Council by Guillermo A. Sherwell, a member of the Inter-American High Commission:

"We are impatient; we want immediate results; we cannot wait. We are like the child who wants to cross the street, who simply must cross even though he will be crushed by a car. Our boys want to run and to play; our university students want credits this year rather than knowledge when they leave the university; our bankers want money to-day rather than the business of the future, and our buyers and sellers want large profits right away rather than a sound, permanent market."

While the above statement was made in reference to our foreign trade, it has an application as regards our domestic business as well.

The rate of growth of the automobile business has been so swift as to make the cultivating of a sound, permanent market appear far less essential than it

has actually become within a comparatively short period of time. With the transition from a condition of striving to fill the demand of the market to that of finding a market to absorb production, the necessity of cultivating a stable market appears to be of paramount importance.

Emphasis on market analysis to determine the market potentialities, and a stressing of those factors which constitute the rendering of a service to that specific market when secured, will lay the foundation for permanency and soundness. A market which is over 80 per cent a replacement one determines the direction in which manufacturers will have to travel. Soundness and permanency are no longer a question of choice but of necessity.

Improving Contracts

THE statement has recently been made that the best dealer organization is the one in which the individual dealer assumes a maximum of personal responsibility. Granting that this is so, our immediate object should be to make the relationship between the manufacturer and the dealer so satisfactory that the latter will be eager to assume the maximum of personal responsibility.

It is only just that the dealer should have the assurance of reaping the fruit from the market that he has cultivated. Sometimes there seems to be a feeling that the dealer should only be allowed to grow to a limited size before a pruning process be applied to his territory. Well-established dealerships have even been taken over and used as a prize to give to someone who has made good at the factory or is in favor with the manufacturer.

Successful building up of a market within a territory must in itself be indicative of a creative spirit and ambition on the part of the dealer. Will not the nibbling away of established territory tend to decrease the dealer's productive efforts?

Now, there are two ways of disposing of pruned territory. Either it is attached to another territory or there may be a new dealership established to handle it. In the latter case it may be joined with the prunings from other contiguous territories. Here the question arises whether the possibilities of increased business through concentration on small territories will justify the increase of numbers in the selling organization.

The taking over of dealerships entire may be a gamble. It is not easy to determine the amount of business that was secured through personal contact of the customers with the former dealer, hence in many cases where it was an important factor there is a temporary if not permanent falling away in volume of business through loss of this contact.

Turnover in the selling organization should be confined to those territories where representation is unsatisfactory. Stability of the selling organization and continuity of selling effort are growing increasingly valuable.

With an improvement in the drawing up of contracts between the manufacturer and dealer, and there is, fortunately, a movement in that direction,

there should be borne in mind not only the granting of the maximum of personal responsibility to the dealer but the making of such responsibility desirable to him.

Lessons of the Roma Crash

ONE more catastrophic accident has been added to the list which marks the progress of lighter-than-air craft to date. Like that to the ZR-2, it will not check further experiments along this line, but the lessons which it teaches should be heeded, in order that further unnecessary loss of life may be avoided. As in the case of the big dirigible which fell into the Humber, the seriousness of the accident and the large number of deaths caused by it resulted from the combination of a number of unfortunate circumstances. So far as can be judged from the information at hand, the primary cause of the accident was failure in the elevator control, which occurred at a comparatively low altitude and caused the big ship to crash to earth at an angle of about 45 deg. Here it should be noted that the machine did not drop, that it did not lack buoyancy, but that when the altitude control ceased to function it assumed a downward inclination and crashed to earth under engine power. Had it been possible to instantly shut down all of the engines, the crash could undoubtedly have been avoided, for the buoyancy of the big bag would then have asserted itself and any downward speed acquired after the elevator gear first ceased to respond would have been quickly checked. Whether the failure to instantly shut off all of the engines was due to inadequate control provisions or to mistakes of the personnel remains to be determined.

Even better than stopping of the engines would have been a reversal of the propellers. This, of course, is impossible with ordinary propellers directly mounted on the crankshafts of the engines. The destruction of the Roma, therefore, is a strong argument in favor of either reversible pitch propellers or of geared propellers with reversing gear, such as installed in the dirigible now being built by the Goodyear company for the Navy. We would not think of putting to sea with a steamer or motor ship without reversing gear, and last week's accident shows that the ability to reverse the power of the propellers is equally essential to safety in a dirigible.

That so many people lost their lives in the accident was probably due to the unfortunate circumstance that the ship, in coming to earth, struck a high tension electric transmission line. Either the contact with the wires or the contact with the ground, which occurred a mere instant later, ripped open the gas bags, and the electric flashes from the broken transmission lines then set fire to the inflammable hydrogen gas. However, if the engines were still running when the crash occurred, there would seem to have been also a considerable danger of the hydrogen-air mixtures, which must have been quickly formed, to have become ignited by the exhaust flame.

This merely goes to show anew that as long as the highly inflammable hydrogen is used as a filling gas, any violent landing is almost certain to be accom-

panied by explosions, leaving the occupants very little chance to escape with their lives. If any further incentive were needed to make the non-inflammable helium (or hydrogen so much diluted with helium as to be non-inflammable) available for the lighter-than-air craft of our Army and Navy, the sad fate of the Roma should furnish it. There is much greater reason to use these non-inflammable filling gases in the present stage of airship development than there will be once the mechanical problems of airship construction have been fully solved, when forced landings will probably be very rare.

Making Men and Money

IN one of his now famous "Common-Sense Editorials," Bruce Barton recently said: "I sometimes think that successful business men should add a line to their letterheads after this fashion: 'John Jones and Company, Builders of Automobiles—and of Men.'"

"And that somehow the Government should discriminate in levying taxes between businesses where men are merely used and those where men are made."

There is always a necessity for trained men in industry. To be assured of such men, industry must do the training. There is frequently too strong a tendency on the part of employers to demand skilled men, when those particular employers are doing very little to provide an opportunity for increased skill or personal development within their own organizations.

The man-building organization has growing within itself potential leaders; great driving forces which will produce and market most efficiently and consequently most profitably; forces which assure the permanent progress of the organization regardless of the coming or going of any individual, however important his function.

Building men instead of merely using them not only fulfills a social and industrial obligation but brings results to the organization in dollars and cents.

Taxes and the Bonus

IN connection with the recent suggestion of Congress to provide a soldiers' bonus largely through the contributions of the automotive industry, the result of the referendum of the Chamber of Commerce of the United States on the bonus is of interest. The members of the Chamber voted decisively against the granting of a bonus for ex-service men, 72 per cent forming the opposition. The referendum was sent out six weeks ago and final results have just been announced. These results confirmed the action of the Chamber previously at two annual meetings and can properly be interpreted as indicative of the sentiment of American business men.

The automotive industry has always stood ready to bear its fair share of tax burden, but the place has been reached where it is already bearing at least that fair share. The proposals of Congress for raising a third of the bonus from those using the products of the automobile industry had no basis in justice.

Notes of Willys-Overland Renewed

Defeat Is Indicated for Bank Creditors

Held Doubtful Now if Mortgage Will Be Placed on Com- pany's Property

NEW YORK, Feb. 28—Bank loans of the Willys-Overland Co., aggregating \$16,556,000, which matured to-day, have been renewed for three months.

This development is the most important in the recent history of the company. It indicates that the bank creditors who proposed to keep control by a \$25,000,000 refinancing program based on mortgage bonds have been defeated by the other interests in the company. Any refinancing program must be submitted to the preferred stockholders, and it now is considered doubtful whether any attempt will be made to mortgage the property.

Toledo Dominates Board

By the election in the past ten days of six Toledo bankers and business men as directors of the company, nine of the eleven members of the board are residents of Toledo. The only representatives of the New York and Chicago bank creditors left on the board are J. R. Harbeck and Elisha Walker of this city.

The fact that control of the company has been shifted to Toledo is evidenced by the announcement that the executive offices which have been maintained in New York for years will be removed to Toledo and that John N. Willys, president of the company, will devote practically all of his attention to Willys-Overland. When he is not on the road promoting sales he will be at Toledo.

The significant announcement also is made that Willys has severed connections with practically all his other interests. While official information on the subject is lacking, there is reason to believe that this means his early retirement from the Republic Motor Truck Co., of which he has had control, but which now is virtually in the hands of its creditors.

Wilson Chosen General Manager

No definite date has been fixed for closing the executive offices here and little is known about what will be done with the personnel of the New York organization. It is assumed that all the officers of the company will be taken to Toledo.

Another important development in the affairs of the company was the election

of Charles B. Wilson, who has been vice-president in charge of operations at Toledo, as general manager. He thus succeeds Walter P. Chrysler as the most powerful influence in the company next to Willys himself.

Wilson is very highly regarded by the Toledo directors, and he was made general manager at a meeting which was not attended by Willys, who is absent on a long trip.

Extension of the bank notes for three months is something of a surprise. It was reported in AUTOMOTIVE INDUSTRIES last week that the new directors had been given 30 days in which to consider the bankers' refinancing program. The Toledo bankers, who would be glad to take over all the bank indebtedness if they could do so, are said to favor a continuance of the policy under which the loans have been reduced by 10 per cent payments in cash from time to time, and it is believed they will insist upon this plan.

Company's Assets, \$100,000,000

The following statement in reference to the affairs of the company has been made by Willys:

Willys-Overland has assets exceeding \$100,000,000. In addition to its Toledo plant, devoted exclusively to manufacture of Overland and Willys-Knight cars and parts, there are three other plants located in Pontiac, Mich., Elmira, N. Y., and Elyria, Ohio.

We have \$78,670,381 paid-in capital stock, \$22,049,500 of which is preferred and \$56,620,881 common. There never has been a bond issue. It has been company's policy to provide part of its working capital by borrowing from banks. Notes payable have been as high as \$34,465,000 and are at present \$16,556,000. Company has \$4,000,000 cash in banks and is meeting all its obligations.

Operating condition is splendid, principally because it has consumed its high-priced material inventory and practically eliminated its obligations for high-priced material.

We are entering a selling season with every reason to expect big business. We have put into operation an improved marketing plan. More than 3500 live dealers have contracted with us, and early this spring we hope to have at least 5000 dealers.

There is no mystery surrounding our financial position, and we fully expect that before the spring season is over the progress we are making will place Willys-Overland in the strong position which facts in the case justify.

(Continued on page 541)

SPAIN TO INVITE U. S.

NEW YORK, Feb. 27—A dispatch from Madrid says that Foreign Minister Hontoria is about to send official invitations to the United States, British, French, Belgian, German, Austrian, Italian and Swiss governments to participate in the International Motor Car Exposition at Barcelona. The exposition will take place some time in May.

Klingensmith, Beall, Hanover to Build Cab

Nat Jacoby Associated in New Company—Separate from Gray Organization

DETROIT, Feb. 28—A company capitalized at \$10,000,000 soon will be incorporated in New York State to manufacture a standard taxicab, which will sell for approximately \$1,200.

Identified with the new enterprise will be Frank L. Klingensmith, president of the Gray Motor Corp., and Frank F. Beall, his associate in that company; H. T. Hanover, president of the Apex Motor Corp., and Nat Jacoby, who is now at the head of the Black and White Cab Co. of New York.

The new corporation will be entirely separate from Gray Motors.

Plant Located

The plans as outlined call for a vehicle from which will be eliminated all unnecessary equipment and attachments. The cabs will be manufactured and operated by the company. A plant already has been located. The operating end of the business will be under the direction of Jacoby.

Connected with the new enterprise will be four automotive engineers who have made a careful study of the taxicab question. It is understood that the vehicle will be an engineering product rather than an assembled one. Operations eventually will be carried on in all the large cities if the plans of the corporation mature.

Control of Guy Disc Valve Engine Acquired

DETROIT, Mar. 1—Frank L. Klingensmith and his associates in the Gray Motor Corp. are reported to have acquired control of the Guy Disc Valve Engine Co. of Ypsilanti, which formerly was a part of the Apex Motor Corp., manufacturers of the Ace car.

Originally the Apex company made both the car and the engine, but because of lack of manufacturing facilities its plant was used exclusively for making the car, which was equipped with a Continental engine.

The original plan was to manufacture the Guy engine in two types, one of four cylinders and one of six. It now is believed that the four will be used for the Gray car and the six for the Ace and the new taxicab which will be built by Klingensmith and his associates.

Harry T. Hanover, president of the Apex company, is also interested in the taxicab corporation, it is understood.

Truck Gain Shown in Growing Output

Improvement Noted in Car Business, Especially in \$800 to \$1,000 Price Class

By JAMES DALTON

NEW YORK, Feb. 28.—The coming of March brings reports that factories in the Detroit district are preparing to speed up production. Sales have increased to a point where it is difficult to fill orders on the present part-time basis and several plants will add a day or a day and a half to their working week.

Better business is felt particularly by the companies making cars in the \$800-\$1,000 price class, but Cadillac and Lincoln both declare they have orders booked far ahead. The Lincoln Motor Co. has just awarded a \$1,000,000 contract for 4- and 7-passenger body models. The Gray Motor Corp and the Rickenbacker Motor Co. have placed large orders for supplies and are preparing to go into production. Other companies are releasing materials earlier than had been expected.

Greater Stress on Fuel Saving

At least two prominent passenger car manufacturers are preparing to bring out new models. It is freely predicted that before the year is over greater stress will be placed on gasoline economy and less on the initial price. High mileage per gallon of gasoline will be one of the talking points for the \$348 assembled car which W. C. Durant has contracted to build.

Evidence of the increased demand for light delivery trucks is found in the fact that 1000 more Reo speed wagons were sold in January than were produced at the factory. Substantial gains also were made in January by makers of heavy-duty trucks.

Dealers Show Confidence

The optimism of manufacturers probably is a reflection of the increased confidence of dealers in all parts of the country. Reports from shows everywhere tell of more sales at retail than last year and greater interest by the public. Everything points to a substantial spring business, both in passenger cars and trucks. Unusually mild weather already has roused the motoring urge.

Business of parts and accessory manufacturers in January was materially larger than in December and the indications are that February

was still better. They are now feeling the full benefit of deflated inventories. Even machine tool makers are having inquiries from vehicle manufacturers who see the need of putting their factories in better position to meet keen competition.

Production of pneumatic tire casings for 1921 reached the unexpectedly large total of 21,820,041, but there are no accurate figures for 1920 with which to make comparisons. It was little, if any, larger in that year, however.

Those companies which really are going after export business are getting it. Sales are being made in steadily increasing volume in Australia, Argentina, Mexico, Porto Rico, South Africa, India and Scandinavia. The tone of the market is better in Cuba, Porto Rico, the Philippines and other small countries. The General Motors Corp. is shipping an average of 125 Buicks and Chevrolets daily from Oshawa, Ontario, and all exporters have been heartened by the recent rise in exchange.

Both domestic and foreign sales for the first two months of the year have been so far ahead of the same period in 1921 that there is danger of rousing exaggerated expectations for the remainder of the year, but the difference in volume will grow smaller as the year progresses.

No Change in Bosch Force Following Kern's Leaving

SPRINGFIELD, MASS., Feb. 27—Arthur T. Murray, president of the American Bosch Magneto Co., declared emphatically to-day that no further changes in the organization were in prospect as a result of the cabled resignation of Martin E. Kern as a director, which was received last week.

Kern, a former Allentown, Pa., banker and organizer of the Bethlehem Motors Corp., figured prominently in the purchase of the Bosch property from the alien property custodian. This sale is being investigated by the Department of Justice. Kern is now abroad.

Murray said he did not know whether or not Kern had disposed of his stock holdings in the company, but asserted that they were not large. He added that the affairs of the company were progressing satisfactorily and that a steady increase is being shown in the volume of business.

SENATE GETS HIGHWAY FUND BILL

WASHINGTON, Feb. 25 — Senator Standfield of Oregon has introduced a bill to extend and carry out the provisions of the Federal Highway Act, providing for an appropriation of \$100,000,000 for each fiscal year from 1923-1927, to aid the States in the construction of rural post roads and other purposes.

Wholesale Business for Lincoln Dropped

Sales Will Be Handled Through Dealers—Ford Executives to Co-operate at Plant

DETROIT, Feb. 25—Completed plans for the distribution of Lincoln cars by the former Lincoln dealer organization and the Ford dealer organization find wholesale business eliminated, all transactions with retailers now being handled directly through the Lincoln factory here or through the 35 Ford factory branches.

Dealers in the metropolitan cities of the country do business directly with the factory, carrying their own stocks of cars and parts. In the smaller cities of the country the Lincoln dealers will deal with the nearest Ford branch and will carry small stocks of cars and parts. In the rural districts the Ford dealers will sell Lincolns on commission, getting their cars from the branches as they sell them, but carrying no parts.

Dealers Work Together

In the cities where there are both Lincoln and Ford dealers, the latter will for the most part act as salesmen for the Lincoln, commissions being fixed to make this attractive. All servicing and the handling of trade-ins involved will be by the Lincoln dealer. Where the Ford dealer would handle the sale and trade-in, a large commission is provided.

Production at the factory will be under the co-operative direction of Lincoln and Ford executives, Wilfred C. Leland, general manager, said to-day. It is not expected to name a new production head specifically for Lincoln he said. This same co-operative idea applying to sales and production has been worked out to apply to every department of the two companies, he stated.

The impression that Ford would dominate the new Lincoln organization and that Ford men would be installed to take over the active management of affairs has not been borne out. All inquiries at the offices of Henry and Edsel Ford as to Lincoln affairs have been referred to Wilfred C. Leland, and any official information on developments has come exclusively from him.

To Amalgamate Plants

One of the first steps of the reorganized company is to amalgamate the Holden avenue plant with the main plant. This step was contemplated before the receivership and is now being put into effect. The Holden avenue plant formerly embraced the screw machine and frame departments. These are now being fitted into the scheme of progressive manufacture at the main plant and will result in large annual economies. As soon as all equipment is moved, the Holden avenue factory will be offered for sale.

Production will be increased so that by March 15 it will reach 30 a day. This rate will be continued until a sufficient

(Continued on page 540)

United Auto Stores Put in Receivership

Similar Application Filed Against Subsidiary—President Claims Company Is Solvent

PHILADELPHIA, Feb. 24—The United Auto Stores, Inc., a chain system of tire and accessory stores, incorporated in Delaware but having its headquarters here and operating fifty-eight branches in four states, has been thrown into receivers' hands. The United Guaranty Corp., organized to sell stock in the United Auto Stores, will soon follow, if an application made in the United States District Court is granted. Steps are being taken to have receivers appointed in every state where the two organizations do business. A deputy sheriff now has charge of the office of the Guaranty company here.

Receivers Make Application

The application for the second receivership was made in the name of Francis F. Burch, a councilman of this city, and Major Samuel A. Whitaker, the temporary receivers named to take over the affairs of the United Auto Stores. The liabilities of the Stores company are stated to be \$1,250,000 and the assets are asserted to be in a much tangled condition. Book assets are given as \$4,000,000. Actual assets are said to be \$281,000 in merchandise and stock in a local foundry.

Attorneys for Edward B. P. Carrier, the president, have issued the following statement:

Edward B. P. Carrier, head of the United Auto Stores, Inc., and also president of the United Guaranty Corp., declares the company is absolutely solvent. It has fifty-eight stores in active operation and the good will of thousands of customers. He closed the stores which were dead wood.

The branch at 131 South Broad Street was closed to reduce overhead expenses. Up to the time that a receiver was appointed no creditor had filed a petition in bankruptcy and no stockholder had filed a petition for receivership.

Some adverse business interests, it seems to Mr. Carrier, are engaged in deliberately conspiring to embarrass him and the company and to seize the company. The company's affairs are embarrassed solely by the financial depression and a dull season in the sale of automobile accessories and had it not been for the business enemies of Mr. Carrier the company would quickly be put on a sound footing.

Carrier Owns Most Voting Stock

Carrier, who is 28 years old and who started in business a few years ago in the tire sales and repair line, is said to own 490 of the 500 voting shares of the Stores company. His attorney also states that \$50,000 liabilities recently had been cancelled.

In the opinion of A. E. Williamson, expert accountant, about \$3,750,000 which is valueless is charged in with the assets. He reports that the concern had heavy overdrafts at local banks.

Joseph L. Kun, assistant United States Attorney, whom Williamson is assisting and who is going over the companies' affairs, asserts that there was an operating loss of \$1,000 a day on accessories and a net deficit of more than \$1,000,000. Kun also asserts that the company lost \$1,385,770 from December, 1919, until the present. The Stores company, which had been operating a short time prior to 1919, was recapitalized for \$1,000,000 in September of that year. The Guaranty company was not formed until April, 1921.

Kun Says Large Profit Made

According to Kun, during the stock increase of the Stores company in 1919, Carrier, through the Guaranty company, underwrote 40,000 shares of common stock at \$1 a share and then sent his salesmen out and sold the stock for \$42 a share, and returned the sum of \$1 to the Stores company and the balance he retained after paying commission to the salesmen. Kun states that agents in charge of Stores company shops were required to buy \$2,000 worth of stock each.

The United Guaranty Corp., it is said, had a contract to sell United Auto Stores, Inc., stock for \$50, receiving a commission of \$26 a share. This gave the chain stores \$24 out of every share sold to go into the treasury. More than 160 stock sales men of the corporation are reported stranded in various cities throughout twenty states, and many have appealed for funds to the local District Attorney's office. The agents for the corporation, it is said, were also employed by Carrier to promote the sale of stock in the Hydro-United Tire Co. of Pottstown, Pa. This fiscal agency is said to have sold through its corps of salesmen \$2,392,280 worth of Stores company stock to between 10,000 and 11,000 men and women, chiefly residing in the East.

New Jersey fishermen are reported to have been heavy purchasers of stock in the Stores company. Many of the employees also were stockholders. Stock purchasers in Reading, Pa., where the

(Continued on page 541)

Voorhis Directs Nash Sales; McCarty, Manager

KENOSHA, WIS., Feb. 27—Charles B. Voorhis has been appointed vice-president and director of sales of the Nash Motors Co., and Earl H. McCarty, formerly assistant sales manager of the Studebaker Corp., has been appointed sales manager.

McCarty joined the Studebaker organization in October, 1902, when he was just out of school. After occupying various positions in the sales department he was appointed manager of the Portland branch of the vehicle division in 1914 and a year later was transferred to Dallas, Tex., in a similar capacity. In 1917 he was taken into the automobile division, going back to Portland as assistant branch manager. Eight months later he was promoted to branch manager and in 1919 was called to South Bend to become assistant sales manager.

New Stock Provided Under Midwest Plans

\$4,500,000 Preferred Will Be Held by Creditors—Working Capital to Be Obtained

INDIANAPOLIS, Feb. 25—Plans for the reorganization and refinancing of the Midwest Engine Co. of this city have been announced by Oscar Stevens of New York, secretary of the creditors' committee of local and outside banks that have had charge of the management of the organization since July 17, 1921.

The plans in brief call for the reorganization of the company into the Midwest Engine Corp.; issuing of \$4,500,000 of preferred stock which will be held by the creditors of the Midwest Engine Co.; issuance of 125,000 shares of common stock; 75 per cent of which will be awarded to share holders of the preferred stock of the Midwest Engine Co.; and flotation of \$3,000,000 of 7 per cent refunding bonds, of which but \$1,000,000 are to be sold immediately and to be applied solely as working capital of the reorganized concern.

Stockholders Approve Plan

One-half of the bonds to be issued now are said to have been subscribed for by holders of preferred stock, and the balance is to be placed with present share holders. About \$1,200,000 of the bonds are to be held in the treasury to provide for the refunding of the present issue, and \$800,000 will be used to satisfy claims of bank and trade creditors. It is said that 85 per cent of the holders of preferred stock have approved of the reorganization plans.

It is believed that the reorganization plan will not affect the personnel of the company and that John Wood will continue as manager. The company is said to have engine contracts with the makers of truck, tractor and bus companies that with normal conditions might run to \$2,000,000 worth of engines a year and that there are prospects of additional contracts that might double this demand under normal requirements.

Voting Powers Depend Upon Dividends

Under the reorganization plan, the holders of the common stock of the Midwest Engine Co. are to drop out of the organization as far as their holdings are concerned. Holders of the new preferred stock will be given voting powers in the corporation after the concern has paid dividends for two consecutive years.

S. A. E. MEETING IN JUNE

NEW YORK, Feb. 27—The Society of Automotive Engineers will hold its 1922 summer meeting at White Sulphur Springs, West Virginia, June 20 to 24. There will be the usual sports and entertainment in addition to the technical program. The S. A. E. expects to get a round trip railroad rate of a fare and a half for the convention.

Dirigible Airship Line to Be Opened

General Air Service Will Operate Craft Like Zeppelins and Use Helium

WASHINGTON, Feb. 27—The General Air Service has been incorporated in Maryland as a successor to the American Investigation Corp. which was organized to investigate the practicability of establishing in this country a commercial dirigible air service. Plans for establishing this service and details of the preliminary investigation were recounted in AUTOMOTIVE INDUSTRIES of Aug. 11 last.

Crowell an Incorporator

Benedict Crowell, former assistant Secretary of War, who headed the American aviation mission to Europe and who is president of the Aero Club of America, is one of the incorporators of the General Air Service. Other men associated with him are: L. V. Benet, president of the Hotchkiss Co.; Owen D. Young, vice-president of the General Electric Co., New York; Marshall Field, 3rd; Col. Charles DeForest Chandler, U. S. Army, retired; Snowden A. Fahnestock; E. M. Herr, president of the Westinghouse Co.; Samuel McRoberts; R. B. Mellon of the Mellon National Bank of Pittsburgh; Theodore Pratt of the Standard Oil Co.; Franklin D. Roosevelt; Benjamin Thaw of Pittsburgh and David Goodrich of New York.

Dr. Johann Schuette of the Schuette-Lanz Airship Co. will be associated with the new corporation. The incorporation papers were filed two weeks after Dr. Schuette returned to the United States. Negotiations with the Zeppelins are understood to have been dropped definitely, but the type of airship which will be used will be similar to the Zeppelin.

New York to Chicago First

Promoters of the company say that the first line to be put into operation will be from New York to Chicago, and that it will be extended to the Pacific Coast when additional ships have been built. Preliminary operations will be begun with two ships, which will be fabricated in Germany but assembled in the United States. They are designed to provide accommodations for 100 passengers and 30 tons of mail and express matter.

The company proposes to use helium instead of hydrogen gas in the operation of dirigibles, which will embrace the latest modifications of both the Zeppelin and Schuette-Lanz patents. It is asserted also that gasoline, another source of fire and explosion, will not be used and that the motor power will be furnished by oil fuel.

Promoters of the company believe that the government will permit the use of the navy hangar at Lakehurst, N. J., or at Cape May for the assembling of the dirigibles while its own housing and terminal facilities are under construction.

Careful consideration has been given to sources of helium supplies, and the government is deeply interested in this question.

"Our aim is to supply dirigible airship service to America," Crowell said, "and as time goes on to link this continent with the rest of the world by aerial routes, a service supplementing existing methods of transportation, one which will traverse space in a minimum of time and supply a means of travel both safe and comfortable."

Court Finds Burdick Tire Assets Exceed Liabilities

INDIANAPOLIS, Feb. 24—Judge Anderson in Federal Court here has denied the petition of alleged creditors of the Burdick Tire & Rubber Co., a Delaware corporation with a factory at Noblesville, Ind., that the company be thrown into bankruptcy and a receiver appointed. Judge Anderson declared that the testimony showed the corporation has assets in excess of its liabilities. He added, however, that it was evident some of the stockholders had been "fim-flammed."

The petition was filed some time ago by Calvin C. Miller and Joseph Lowman of Peble County, Ohio, creditors of the tire company, who charged mismanagement of the company, insolvency and efforts to defraud stockholders.

Root and Pavey Become Officers in Parts Firm

COLUMBUS, OHIO, Feb. 27—The Automotive Parts Co., capitalized at \$250,000, has been organized by Columbus capitalists to operate a wholesale business in parts and accessories. H. C. Root, for the past eight years general manager of the Westcott Motor Car Co., is president; Ernest E. Pavey, receiver for the Monitor Motor Car Co., is vice-president. Root will also be general manager of the business.

The concern will have exclusive selling rights in Ohio for Continental Motors, Timken axles and bearings, Warner transmission systems, Borg & Beck clutches, Spicer universal joints and other parts. The headquarters will be in this city.

GILSON BUYS GLOBE PLANT

MILWAUKEE, Feb. 27—Harry W. Bolens, president and general manager of the Gilson Manufacturing Co., Port Washington, Wis., has purchased the plant and equipment of the defunct Globe Metal Products Co. of Sheboygan, Wis., at receiver's auction, for \$65,700. The property consists of a foundry and machine shop. The Gilson company manufactures gas engines, farm implements, tools, etc., and recently developed a power hoe and lawn mower tractor, which, it is said, probably will be placed in production in the former Globe works. The implement is a combination cultivator and lawn mower and sells for \$180.

"Pittsburgh Plus" First Hearing Held

Steel Corporation Seeks to Show Consumers Prosper Despite Alleged Handicap

MILWAUKEE, Feb. 27—The Federal Trade Commission has just completed the first of the series of hearings it will conduct in various steel consuming centers of the West upon its complaint against the United States Steel Corp. and its subsidiaries, seeking the abolition of the alleged practice of selling rolled steel material on a Pittsburgh base and charging freight from Pittsburgh to fabricators' plants, regardless of the point of origin of the shipment. The practice is commonly known as "Pittsburgh Plus."

The testimony of witnesses generally aimed to show that western fabricators are unable to compete with competitors east of Chicago in the eastern territory, because shops located nearer Pittsburgh than Milwaukee are able to lay down products cheaper because of the advantage of freight rates.

Rates Higher to Milwaukee

The freight rate from Pittsburgh to Milwaukee is 41.5 cents per 100 lbs., while it is much less from Pittsburgh to Cleveland, Detroit, Cincinnati, Indianapolis, Toledo and other competitive points, so that competitors at these points, due to the Pittsburgh basing point practice, are able to acquire their raw steel at a lower cost than Milwaukee or other western plants must bear.

Since Milwaukee is one of the leading centers of the automotive parts industry, and the passenger car as well as motor truck industries are centered largely in points east of Chicago, the effect of "Pittsburgh Plus" as brought out at the hearing was shown to be particularly disadvantageous to manufacturers of this class of rolled steel product of a standard character. On patented articles the disadvantage was shown to be less severe because of the obvious fact that manufacturers of patented articles have more definite control of selling prices on such goods than on standard articles.

Counsel for the Steel corporation laid emphasis on the fact that the hundreds of invoices, purchase orders and letters of quotation introduced into the record by Milwaukee consumers invariably showed that sales were billed f.o.b. Milwaukee, to prove that there is no Pittsburgh basing point in existence. Their cross examination of witnesses usually followed the line of drawing out testimony to show that Milwaukee consumers have prospered and grown in a normal way despite any handicaps they might claim they were under.

CONCENTRATES ON 8 H.P. TALBOT

LONDON, Feb. 20 (by mail)—The S. T. D. Co., maker of Sunbeams, Talbots and Darracqs, is concentrating on the output of the light 8 h.p. Talbot.

Seeking Way to Deal with Dunlop Assets

English Director Comes to America on Investigation, Szarvasy Tells Stockholders

LONDON, Feb. 20 (by mail)—The following statement in reference to the American Dunlop Co. was made by F. Alexander Szarvasy, chairman of the board, at a recent meeting of shareholders:

"In accordance with the program outlined to you at the last annual general meeting, we made an offer to the Dunlop American Pool Certificate holders of two Dunlop Ordinary shares for every three pool shares, and, as shown in the report, our company now holds, including the £1,000,000 invested by ourselves some time ago, a 96½ per cent interest in the equity of the American company.

Large Sum Owed

"In addition, the American company owes us on open account £806,000, our total investment at the date of the account thus being approximately £3,780,000 to which must be added the £560,000 advanced last month."

He stated further:

The American company created in January, 1920, a one year bond issue of \$6,000,000 guaranteed by ourselves, of which \$4,545,000 were placed and a further \$600,000 were used as collateral security against advances from local banks. These bonds were held partly by a number of trade creditors of the American company, partly by local bankers, and partly by firms and individuals in this country who are largely interested in this company.

We made arrangements last month with our bankers whereby the whole of the bonds held by creditors in America was purchased from them for our account at a cost of approximately \$560,000, and we succeeded in making arrangements with the local bankers in America, and with the holders of the bonds in England, to postpone the date for the repayment of their bonds for a period of 12 months. Our own holding of these bonds, therefore, is now more than 50 per cent of the total, and we have 12 months before they become due, within which we can deal with the assets at our leisure.

Three Suggestions Made

There appear to be three ways of dealing with these assets. First, by making arrangements with banking interests in America for effecting the finance—this would involve raising \$12,000,000 to \$14,000,000 in order to repay the existing bond issue, provide working capital, and enable the works to be started on a moderate program of production, and, if trade conditions permitted, to gradually work up to the full production program of 44,000 tires per week.

This plan has proved to be unattainable for the moment. My colleague, Mr. Tait, made a special journey to America in October last in order to explore all the possible channels, and he was successful in inducing two very important firms of bankers to consider the proposition. They arranged to send their expert over here to investigate the position of the home company, whose guarantee, as an essential condition, was to have been attached to the bonds proposed to be issued in America.

I have not seen the report of this expert, but I am informed on good authority that the report was quite favorable regarding our position here, and I may tell you that I had a long interview with this gentleman and found him greatly impressed with the thoroughness with which we were carrying through our internal reorganization, and with the manner in which we dealt with all our difficult problems.

I am confident, therefore, that the reason why this permanent finance was not carried through must be looked for in the general conditions of the tire trade and in the prevalent disorganization of industry in America. We all know that America is suffering even more severely than we, owing to the trade depression, and the latest statistics show that the largest American tire companies are only operating up to 60 to 70 per cent of their capacity.

In this respect, therefore, our prospects for turning the large amount we have invested in the American enterprise to a profitable use is delayed for the time being.

The other way of dealing with these assets would be by realizing by way of sale, and here the value of the property is naturally of the utmost importance. The actual amount of money spent, directly and indirectly, on this asset is approximately £6,000,000; therefore, considerably more than the figure at which it stands in our balance-sheet. Neither must we lose sight of the fact that this investment includes a cotton mill, which is operating today at its full capacity, and is a valuable asset.

The third and most promising avenue seems to be in a combination with existing interests in America, and in order to see how far we can proceed on this line, one of your directors, Mr. Proctor, has just left for America. He was out there a year ago, and is fully conversant with all the circumstances so that we are hopeful as to the success of his mission.

Seiberling to Introduce New Tire to Public April 3

AKRON, OHIO, Feb. 27—The new Seiberling cord tire, perfected by F. A. Seiberling and now being manufactured by the Seiberling Rubber Co., of which he is president, will be formally introduced to the American motoring public during the week of April 3.

The Seiberling company expects to sign up 1000 dealers scattered throughout the United States by that time and to hold a simultaneous Seiberling dealers' opening week. The same window display will be used during the week by all Seiberling dealers.

Combined production of the two Seiberling plants, at New Castle, Pa., and Barberton, Ohio, including the Seiberling tires and the old line of Portage cords and fabric tires, now exceeds 800 daily.

Sandusky Syndicate Buys Maibohm Motors

TOLEDO, Feb. 28—A syndicate of Sandusky business men has purchased the assets of the Maibohm Motors Co. subject to the approval of the creditors. The purchasers hope to go forward under the present plan of operation. The creditors' committee believes consent of the stockholders to the sale may be obtained soon.

Bigger Output, Plan of G. M. of Canada

New Schedule Calls for 175 to 200 Cars Daily—Plants on Full Time

OSHAWA, ONT., Feb. 27—Plants of General Motors of Canada, Ltd., at Oshawa and Walkerville, are operating full time, and a number of the departments are working overtime in the production of the McLaughlin-Buick, Chevrolet, Oldsmobile and Oakland motor cars. The daily output for the past three months has been 150 finished automobiles, and the schedule for the next two months calls for a daily output of from 175 to 200. This will be the largest schedule in the history of the Canadian company.

The payroll for the month ending Feb. 15 was at the rate of \$440,000 a month. The reason, of course, for the size of this payroll is that very few parts are brought in from the United States. It is an established policy of the company to manufacture every possible part of the car from Canadian material and with Canadian labor.

President R. S. McLaughlin is optimistic with respect to Canadian business. The past three months have seen a healthy increase in the domestic market for motor cars.

Production schedules for the various units have been arranged to take care of an increased home demand, as well as the large foreign demand. The fact that General Motors factories are running to capacity to supply Canadian and overseas business has enabled them to distribute overhead expenses, thus effecting economies represented in recent substantial price reductions. Canadian purchasers of General Motors products in this way secure a direct advantage as a result of the big production, made necessary by export demand.

Yeomans Named Receiver for Illinois Body Company

DANVILLE, ILL., Feb. 27—Victor Yeomans has been appointed receiver for the United Automotive Body Co. which operates a plant at Tilton near this city. Judge English of the Federal Court made the appointment following the presentation of a petition from a committee of creditors. The corporation was formed in Delaware, but, it is said, had not been authorized to do business in Illinois.

It is understood that the company was merely a sales organization for the parent company, the L. C. Graves Corp., located in Lansing and Detroit.

The question of ownership of three carloads of finished bodies and supplies has not been settled, but claim has been filed by the creditors here on the grounds that the corporation has no standing in Illinois and that they were consigned simply to the local branch. Receiver Yeomans has taken charge.

Seek Lincoln Data from War Department

Attorney General Conducting Inquiry Into \$6,000,000 Claim
Filed by Government

WASHINGTON, Feb. 28—Attorney General Daugherty to-day advised AUTOMOTIVE INDUSTRIES that Assistant-to-the-Attorney General Goff is conducting an inquiry into the affairs of the Lincoln Motors Co. to determine the effect of immediate prosecution of the Government's claim for \$6,000,000 against the Detroit Trust Co. as receiver. Senator Townsend of Michigan and James Murfin, attorney for the creditors, advised the attorney general that pushing this claim would prove disastrous for many business men and banks who are creditors of the Lincoln company.

Mr. Daugherty stated that he was also investigating the grounds upon which the War Department bases its charges. He stated that the questions at issue involve matters of taxes, manufacture of motors, and other details which he refused to make known. The attorney general insisted that nothing definite could be given out at this time until the Department of Justice had reached its own conclusions on the representations made by the War Department. Murfin conferred with the attorney general personally on last Friday, relative to the claims of creditor banks and merchandise creditors and set forth their position.

It was indicated by Mr. Daugherty that the matter hinged on changes in contracts with the Government.

Sale in Delaware

WILMINGTON, DEL., March 1—The patents, rights, interests in patents and applications therefor; trademarks, trade names and all interests therein; bonds, obligations, bills of lading shipping, receipts, promissory notes, drafts and accounts receivable, as well as all other rights or causes of action arising upon contracts or from the alleged unlawful taking or detention of, or injury to property of the Lincoln Motors Co., and also the corporate franchise of the company, were sold here yesterday by the receivers to George B. Perry of Detroit, Mich., for \$10,000.

Whom Perry represented could not be learned, but it was believed here he represented the Ford interests. The property sold was that of the company held to be in the jurisdiction of the United States District Court for Delaware.

Aeronautical Chamber Elects Its Governors

NEW YORK, Feb. 28—An annual aeronautical institute conducted by and for engineers and designers to exchange thought on the scientific development of aviation has been proposed by Samuel

S. Bradley, temporary president of the Aeronautical Chamber of Commerce. The organization also will promote flying meets, demonstrations and aeronautical shows in addition to co-operating with the various departments and bureaus of the Government.

The following governors have been elected by the membership: C. C. Witmer, president of the Airship Manufacturing Co.; Frank H. Russell, vice-president, Curtiss Aeroplane & Motor Corp.; John M. Larsen, president, J. L. Aircraft Corp.; Grover C. Loening, president, Loening Aeronautical Engineering Corp.; Samuel S. Bradley, general manager, Manufacturers Aircraft Association; F. B. Rentschler, president, Wright Aeronautical Corp.; B. E. Bushnell, director of sales, Stewart Hartshorn Co.; Charles H. Colvin, general manager, Pioneer Instrument Co.; Sherman M. Fairchild, president, Fairchild Aerial Camera Corp.; Lawrence Sperry, president, Lawrence Sperry Aircraft Corp., and Charles F. Redden, president, Aeromarine Sales & Engineering Co. and Aeromarine Airways, Inc.

Court Fixes Upset Price for Sale of Pan-American

DECATUR, ILL., Feb. 29—Judge Baldwin in the circuit court has issued an order for the public sale of the Pan-American Motors Corp. Edward Danner, president and receiver, denied that the corporation was insolvent and that efforts of the directors to dissolve the company were unsuccessful because they lacked the necessary two-thirds vote.

Judge Baldwin ordered the receiver to obtain at least 75 per cent of the inventory value in selling the chattel property. The inventory shows the net value of the corporation to be \$313,835. Of this \$21,479 is in notes given in payment for common stock and \$2,172 for preferred. It is estimated that holders of common stock will realize twenty cents on the dollar, while holders of preferred will receive the full par value of \$10 per share.

There are 34 finished motor cars, valued at \$37,000, and other supplies totaling \$154,000. Service cars, trucks, machinery, tools and equipment are estimated at \$22,000 more. A mortgage on the real estate of \$81,000 is held by a local bank.

FRENCH LOOK TOWARD IRELAND

LONDON, Feb. 20 (by mail)—The value of motor vehicles imported into Ireland increased from \$4,200,000 in 1919 to \$15,000,000 in 1920. The formation of the Irish Free State has caused French manufacturers to realize the value of this market, and a campaign is to be launched with a view to creating demand for French products.

BUS HOLDS 51 PERSONS

OTTAWA, ONT., Feb. 27—The Ottawa Car Manufacturing Co. has completed the first motor bus for the Toronto Transportation Commission. Accommodation has been provided for 51 persons, the second deck being reached by means of a stairway leading from the rear platform.

Full Time Program Growing in Detroit

Factories Increase Production Incident to Steady Improvement in Business Conditions

DETROIT, Feb. 27—Steady improvement in business conditions during the week has found a number of Detroit manufacturing companies going upon full time schedules for the first time this year. Notable among these is the Maxwell Motor Corp., the demand for whose new line is running higher weekly, with consequent stepping up almost daily in the number of cars manufactured.

Maxwell is working steadily toward the improvement of service conditions and has several plans toward this end under contemplation. It is probable that a number of factory controlled service stations will be located in important cities of the country, so that owners may never be more than a few hours away from genuine replacement parts.

Ford Orders Increasing

Ford Motor Co. has not entered upon a full time manufacturing schedule yet, but orders are reported steadily increasing and full time probably will start early in March. Dodge Brothers is working at full capacity, the schedule being approximately 600 cars daily.

Though Ford officials deny the probability of the early announcement of a new Ford truck of 2 to 3-ton capacity, it is not denied that the company has a new truck fully developed which is to be introduced. Only market conditions are considered to be keeping the new vehicle under cover. A betterment in general business conditions by the late spring or early summer probably will lead to an announcement then.

Reo Motor Co. has improved its line by adding many refinements, among which are new fenders and a new frame, drum type headlights and polished aluminum dashboard controls and finishings. The cars thus equipped were not shown at either of the two national shows.

6000 Jewetts by July 1

Jewett Motors will go into production March 10 on its phaeton model and will build about 500 the first month. This production will be increased to about 1800 in April and will continue at that number until July 1, by which time 6000 cars will be completed. A new schedule will be laid out at that time.

The company will confine its building operations to the phaeton for the first few months and will start the sedan about May 1. The other models, roadster and coupe, will be added later. The phaeton is priced at \$1,065 and the sedan at \$1,395. Prices on the other models have not been fixed.

Manufacturing of the Jewett line will be carried on at the Paige factories. Two new assembly tracks will be laid out for

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Full Time Program Growing in Detroit

Factories Increase Production Incident to Steady Improvement in Business

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the Jewett line. There is sufficient room at the factory for both Paige and Jewett production in 1922, according to factory engineers. Forty thousand dealers will be circularized on the new Jewett line this week.

Dort Motor Car Co. has been given permission by the Michigan Securities Commission to sell 25,000 shares of no par value common stock at \$20 a share. In granting the stock issue, all outstanding stock of the company, which heretofore has been practically a closed corporation, was ordered escrowed with the commission. This includes 45,067 shares in the hands of F. A. Aldrich, as trustee, and 125,000 other outstanding shares, including 2100 shares deposited with Flint banks as collateral. The trustees' stock, the property of J. Dallas Dort and F. A. Aldrich, which was issued for the assets of the old Dort Carriage Co. at the time of the organization of Dort motors, was ordered turned into the treasury of the company as a gift, making 75,000 shares in the treasury.

Rickenbacker Motor Co. is now producing 10 cars daily and has contracts with 25 distributors. The company is selling \$3,000,000 of its authorized \$5,000,000 common at \$10 par. Two hundred thousand shares went to the promoters in consideration for development work and property turned over to the new corporation. Experimental work is estimated to have cost \$450,000. Half of the \$2,000,000 stock issued for development, plant, etc., and held by the officers is in escrow with the Michigan state treasurer until the company has earned 6 per cent on all stock outstanding for a year.

Stevenson Installs Plant

DETROIT, Feb. 28—The Stevenson Gear Co. will install a plant for the manufacture of gears by its multiple shaper method in the factory of the Michigan Pattern Machine Co. Substantial orders are reported from a number of companies, and production will be started at once. By its lease the company will have the use of \$200,000 worth of machinery, in addition to its multiple shaper equipment.

SHEFFIELD WORKS CLOSED

LONDON, Feb. 20 (By Mail)—The Sheffield works of the Sheffield Simplex Motor Car Co., in which Earl Fitzwilliam holds a predominating interest, have been closed, because production is in advance of sales. The manufacture of cars, motorcycles and commercial vehicles has been continued until all the storage accommodation is occupied.

Business Better!

SOUTH BEND, IND., Feb. 24—From Jan. 1 to Feb. 10 the Studebaker Corp. of America manufactured 10,683 cars, as compared with 3528 in the same period a year ago. Production for the month of January was 7243. Studebaker expects during 1922 to produce 93,000 vehicles, as compared with 68,000 in 1921 and 53,000 in 1920.

The New York City area shows the largest increase in business over a year ago, the increase being 135 per cent. Boston has an increase of 84 per cent, and the Philadelphia territory, 61 per cent. Studebaker production is running on a basis of 40 per cent among the three models of Light Six; 40 per cent Special Six and 20 per cent Big Six.

DETROIT, Feb. 25—The Packard Motor Car Co. is selling about 25 per cent more trucks than in the same period last year. Among the purchasers are large business organizations which have just come into the market, and a substantial truck replacement business is expected by Packard this year. There also are indications of an increased demand for trucks in highway construction, as well as in the passenger transport business.

ELGIN, ILL., Feb. 25—The Elgin Motor Car Corp. reports that its shipments for January were 200 per cent better than for December and that February shipments have been 35 per cent better than January. The production schedule for March calls for 300 cars. The company recently has closed contracts with five large exclusive distributing organizations and seven direct dealers.

DETROIT, Feb. 27—The Ford Motor Car Co. of Canada has increased its manufacturing schedule to 5 days a week of 8¼ hours each. It is turning out 218 cars a day. There also has been an increase in the parts business.

CLEVELAND, Feb. 27—The Jordan Motor Car Co. reports that its production for the month of February was 350 per cent better than for February 1920.

Gain in Parts Trade Mounts to 30 Per Cent

Improvement in Conditions Is Reported from All Sections of the Country

NEW YORK, Feb. 27—Further evidence that motor and accessory manufacturers are receiving substantial orders was given at a group meeting last week of credit men from representative companies. The increase over recent months probably averages about 30 per cent. Following are paraphrases of some of the reports made at this meeting.

"Small local truck builders appear to be very active, especially in the East. We have received many small orders from builders of this type."

"One of our customers in the South who had a large account with us and whose notes we had carried for a year and a half recently paid us 20 per cent on account."

"New business is being placed for future delivery. We believe orders will increase from month to month."

"We have been very much surprised in the last month at the great number of inquiries we have received for new plant equipment and at the quantity of replacement business we have been able to get. These orders have not come from companies which are just going into the field but from old line plants which are replacing worn out machinery."

"We are going to have a good month this month and March will be a good month."

"Our schedules up to July are about 50 per cent."

"We are very much more active than we have been. As far as our automobile business goes we have specifications from practically all our customers up to July."

"We think we see a little change for the better in the western agricultural districts and we are looking for different conditions than have prevailed in the past year."

RUSHING DODGE, FORD FORGINGS

SPRINGFIELD, MASS., Feb. 27—Manufactures of automobile parts are going forward at an increased pace. Moore Drop Forging Co. is rushing forgings for Dodge Brothers and Ford cars. Bausch Machine Tool Co. is producing gears for Ford trucks and tractors at the rate of 300 a day, and is entering this week on the making of demountable rims of new design for the Franklin. The reorganized Harley Co. has its parts production under way. This seasonal activity shows a marked advance over a year ago.

FORD OPERATING IN JAPAN

DETROIT, Feb. 27—The Japanese assembly plant of the Ford Motor Co. at Negishi is now equipped to turn out 15 assembled chassis each working day of eight hours. Three former Detroit employees are in charge of the force of 46 Japanese laborers. Standard Ford methods have been adopted throughout.

The company estimates that there are 10,500 cars running in Japan, of which 4500 are Fords.

U. S. CHAMBER OPPOSES BONUS

WASHINGTON, Feb. 24—Seventy-two per cent of the membership of the Chamber of Commerce of the United States oppose cash bonus for soldiers, according to the result of the referendum vote recently taken. The vote was intended to put the Chamber's membership definitely on record and to supplement a declaration by resolutions adopted previously at two annual meetings.

Milwaukee Parts Business Quickens

Passenger Car Builders Report Increased Production—Truck Prospects Encouraging

MILWAUKEE, Feb. 27—The automotive parts industry, which to a large extent marked time in January, experienced a quickening in February which was particularly noticeable in the last two weeks and is due to the more definite delivery schedules submitted by manufacturers, who through the national, district and local shows have been able to get a line on the possible demands of their market.

Passenger car builders in Milwaukee and vicinity also brought up production in the period now closing, compared with January. Tire manufacturing and distribution are far more satisfactory than last year at this time. The manufacture of trucks is making slow progress, but prospects are regarded as being more promising than a year ago.

Public Attitude Changing

Local dealers feel that the attitude of the public on passenger car prices has started to undergo a change which is taken to mean that a great many prospective buyers are satisfied that the bottom has been reached and little if anything is to be gained by waiting longer to buy.

There are, of course, many people who feel that before spring manufacturers will be forced to make further concessions in order to meet competition. The trade is engaged in combing prospect lists built up from patronage of the recent annual winter show and is meeting more and more success in closing sales. Business, however, is quiet, as might be expected at this period of the year.

Bassick Is Operating at 70 Per Cent of 1920

BRIDGEPORT, CONN., Feb. 25—Greater demand for automobile and cabinet hardware manufactured by the concern is credited as responsible for the fact that January orders of the Bassick Co. of this city showed an increase of approximately 100 per cent over the amount received during the same period last year, bringing the plant's production up to 70 per cent of what it was during the year 1920.

The man-hours per week at the local factory have been increased 20 per cent since the first of the year, as a result of the increased orders. A similar expansion in production is underway at the Newark, N. J., factory. The export business there is reported for the month of January as having increased by 10 per cent over exports for the month of January, 1921.

NEW STUTZ REFINEMENTS

INDIANAPOLIS, Feb. 27—A number of refinements have been made in the

Stutz cars, particularly in the engine. It is claimed that the new manifold system adopted gives a 50 per cent greater power output from the same cylinder dimensions. According to Chester S. Ricker, who has been employed as consulting engineer by the Stutz company during the past year, the new manifold is so arranged that changes in water jacket temperatures of 100 deg. do not seem to affect the operation.

The chassis weight remains the same as on the previous series, and the acceleration of from 10 to 60 miles per hour is claimed to be quicker than from 10 to 50 in the previous series. Complete specifications and details of the new product will be announced to dealers in the near future. It is stated that the Stutz company is about to enter an intensive merchandising campaign.

Says Industry Leads in Deflation Process

DETROIT, Feb. 27—The process of deflation has gone farther in the automotive industry than in any other, in the opinion of William Robert Wilson, president of the Maxwell Motors Corp. Discussing the general situation in the industry, he said:

The automobile manufacturer realizes that competition is keener than ever, that there must be no doubt about his product, but that the good car, correctly priced, need have little fear of a satiated market. Also, that conservative marketing and expert fingers on the pulse of demand will establish the automobile business on a more stable basis than ever.

The automobile dealer is, of his own wise, converted to a firmly conservative business policy. He knows that the day of the telephone order is gone for good—for the good of all concerned. He is in a frame of mind amicable to present conditions. He knows that he must go after business and is fully aware that the offer of real service is a genuine sales need. He is prepared to follow these dictates for on them his 1922 success is assured.

I believe the public is more deeply interested in the automobile than ever, but more critical. It is selecting cars more carefully and is more insistent on quality as evidenced by the New York and Chicago shows. The New York show drew record attendance, but not record sales, yet those manufacturers who offered a product of evident value found an agreeable amount of business.

Efforts to Reorganize Kelley Tire Abandoned

NEW HAVEN, CONN., Feb. 27—As receiver for the Kelley Tire & Rubber Co. of West Haven, Attorney Albert H. Barclay of this city has petitioned Judge George E. Hinman of the superior court here for authorization to expend \$500 in advertising the concern's assets for sale. Efforts at reorganization have been abandoned, and the receiver will attempt to dispose of the plant and fixtures to the highest bidders, indicating that there is little likelihood that the many stockholders throughout the state will get anything out of the proceeds.

Hudson, Essex Sales Increase 100 Per Cent

Gain Over Year Ago—March Will See Plant on Practically Full Time

DETROIT, Feb. 28—February business of the Hudson and Essex companies will exceed that of the same month last year by 100 per cent, it was stated today by President Roy D. Chapin. Production in March will be increased to a point where it will run 200 per cent in excess of 1921 and will place the factory on practically full time operation, Chapin added. Releases on parts have been almost tripled in some instances.

Other manufacturers with whom he has talked declare business to be far in excess of early expectations, he said. Prospects for a strong spring and summer demand are excellent. All the shows thus far held have been more successful than expected and attendance has been record breaking in most cities. This is regarded as a positive indication of public interest in automobiles.

Financial Position Strong

Chapin said the sale of its new coach by his company has been large and that the campaign for business in enclosed cars has been successful. Dealers have been gratified at having a lower priced enclosed model.

The financial position of the Hudson Motor Car Co. is exceptionally strong. Its quick assets as of Nov. 30, 1921, were \$5,804,630 and its current liabilities, \$2,340,145. The total assets were \$14,955,692. With a capital of only \$1,987,260, the company had a surplus of \$10,508,287.

Legislator Would Increase Truck Rates in New York

ALBANY, Feb. 27—A proposal to increase the rates for registration of automobile trucks in New York State has been introduced in the Legislature by Senator Seymour Lowman of Chenung County. The proposed rates would be identical with those now in force in Pennsylvania.

Senator Lowman's schedule is as follows: For each vehicle having a combined weight and carrying capacity of two tons, or less, an annual fee of \$15; of two tons and not more than three tons, \$20; more than three and not more than four tons, \$25; more than four tons and not more than five, \$30; more than five and not more than six tons, \$50; more than six and not more than seven tons, \$60; more than seven tons and not more than eight, \$75; more than eight and not more than ten tons, \$100, and more than ten tons, \$150.

The excessive wear and tear on state highways resulting from increased use of motor truck transportation is cited as a reason for the proposal to increase the registration fees for the trucks. The passenger registration fee would not be changed.

Heavy Write-Offs Cause G. M. Loss

Balance of \$38,680,770 Charged Against Surplus, Preliminary Report Shows

NEW YORK, March 2—A preliminary report of the General Motors Corp. for the calendar year 1921 shows a net income after ordinary charges of \$5,784,782, but after charges for extraordinary losses and adjustments aggregating \$44,465,552, there remained a balance of \$38,680,770 to be charged against surplus.

A statement by Pierre duPont says that a statement of 1921 earnings would be misleading if attention were not called to the losses and adjustments in units undergoing liquidation and reorganization. To make this situation clear, he divides operations of 1921 into two classes, one of which includes the divisions thoroughly established and whose product is so standardized that it does not require readjustment. The other class includes divisions undergoing reorganization and rearrangement, including some cases of complete abandonment and liquidation.

Sales in Two Classes

Net sales in 1921 for the class A, or thoroughly organized units of the corporation, were \$225,261,110, as compared with \$370,288,235 in 1920. The net sales of the class B units, or those undergoing reorganization last year, were \$79,226,133, as compared with \$197,032,368 in 1920. The total for 1921 was \$304,487,243, as against \$567,320,603 in 1920.

The net earnings of the class A units were \$29,671,494, while there were losses of \$16,431,547 on the class B units, leaving net earnings from operations as a whole of \$13,239,946. From these earnings were deducted interest of \$5,281,084 on notes payable and \$2,174,080 for the employees investment fund, leaving a net income after ordinary charges of \$5,784,782.

Charges for extraordinary losses and adjustments were: write down of inventories Dec. 31, 1921, to cost or market, which ever was lower, \$16,603,073; provision for refunds due dealers and distributors on account of price reduction, effective Jan. 1, 1922, \$2,441,376; cost of cancellation of commitments, rebates on sales in 1920 account of price guarantees and other miscellaneous losses charged off in 1921, \$11,421,102; special reserve established Dec. 31, 1921, to cover anticipated losses and unforeseen contingencies pertaining to 1921 on prior years but not at present definitely ascertainable, \$14,000,000, making a total of \$44,465,552.

President du Pont pointed to the satisfactory showing of the Class A units and added that adjustments in inventories with rearrangement and improvement in the quality of its product has placed the corporation in a position to conduct its operations in 1922 with every promise of profitable results. The corporation has taken all possible losses. The capital and surplus account, after

allowing an equity of \$352.39 per share on preferred and debenture stock, leaves an equity of \$262,278,135 on common stock valued at \$10 per share. This would leave a common stock surplus of \$55,814,160.

Comparative Balance Sheet

A condensed comparative consolidated balance sheet as of Dec. 31, 1921 and 1920 shows:

	CURRENT ASSETS	
	Dec. 31, 1921	Dec. 31, 1920
Cash in banks and on hand.....	\$40,057,401.53	\$47,332,842.21
United States Government Bonds	5,228.04	41,262.21
Marketable securities	27,009.31	34,096.31
Sight drafts against B/L attached and C. O. D.	4,677,241.39	9,667,580.59
Notes receivable.....	4,794,978.99	13,449,376.90
Accounts receivable and trade acceptances, customers and others	18,944,844.09	22,233,886.80
Inventories at cost or market, whichever is lower	108,762,625.35	164,684,678.72
Prepaid expenses	1,944,988.35	1,891,854.06
Total Current Assets	\$179,214,317.05	\$259,336,577.80
	CURRENT LIABILITIES	
	Dec. 31, 1921	Dec. 31, 1920
Accounts payable (and trade acceptances in 1920)	\$15,640,429.41	\$27,160,681.23
Notes payable.....	48,974,996.29	72,421,451.45
Taxes, payrolls and sundries accrued not due	15,894,778.40	14,101,794.90
Accrued dividends on Preferred and Debenture stock, payable February 1....	1,043,763.07	1,018,943.73
Total Current Liabilities ..	\$81,553,967.17	\$114,702,871.31

Wholesale Business for Lincoln Dropped

(Continued from page 533)

back-log of orders has been accumulated to warrant an expansion. From time to time additions will be made to the plant to permit the company to make parts that are now being bought. The manufacture of its own bodies is a detail that is being studied closely by the company.

Export business of the company will be handled through the Ford export organization ultimately, Leland said, but this will be passed over until the handling of domestic business is operating smoothly.

Regarding the most recent claim by the government against Lincoln, W. C. Leland expressed confidence that this would be dismissed as soon as the facts were subjected to intelligent scrutiny.

CANADIAN GARY INCREASES

TORONTO, ONTARIO, March 1—Increases in the prices of all its models are announced by the Gary Motor Truck Corp. of Canada, Ltd.

\$100 to \$550 Price Cut on Case Tractor

Company Is Building New Model with Capacity of 8 to 10 Plows

RACINE, WIS., March 1—Price reductions ranging from \$100 to \$550 on its farm tractors are announced by the J. I. Case Threshing Machine Co. The list follows:

	Old Price	New Price
Case 10-18.....	\$800	\$700
Case 15-27.....	1,680	1,420
Case 22-40.....	3,100	2,550

The Case company also is building a large size tractor known as the Case 40-72 for which the price has not been fixed. It will be powered with a Case four-cylinder engine and will have a plowing capacity of from 8 to 10 plows.

"WATERLOO" REDUCED \$375

WATERLOO, IOWA, Feb. 27—The Waterloo Gasoline Engine Co. announces that the price of its Waterloo Boy Tractor has been reduced from \$1,050 to \$675. This brings the price below the pre-war level.

Material Cut in Price Made by Acason Truck

DETROIT, March 1—The Acason Motor Truck Co. has made material reductions in prices on its heavier models. The list follows:

	Old Price	New Price
¾-ton	\$1,650	\$1,650
1½-ton	2,495	1,950
2½-ton	3,295	2,750
3½-ton	4,295	3,450
5-ton	5,295	4,350

The one ton model which sold for \$2,260 has been discontinued.

KEARNS MAKES REDUCTION

DANVILLE, PA., Feb. 28 — The Kearns-Dughie Motors Corp. announces a reduction in its model "H" 1-ton chassis from \$1,600 to \$1,150 and its model "M" 2-ton chassis from \$2,200 to \$1,650. The price of its model "H" chassis complete with its standard hand-made post express body is \$1,350.

DUPLEX 3½-TON REDUCED

LANSING, MICH., Feb. 27—The Duplex Truck Co. has reduced the price of its model E 3½-ton truck from \$4,250 to \$3,500. The 1½-ton truck will continue to sell for \$2,775, but the capacity will be increased to two tons and considerable equipment will be added.

The announcement contained in the Feb. 9 issue of AUTOMOTIVE INDUSTRIES, in regard to the bringing out by the Packard Motor Car Co. of a new line of single six cars was a mistake, and we are glad to make correction of that item.

N. A. C. C. Discusses Used Car Remedies

Comprehensive Plan Presented by Which Dealers Would Be Given Certificates

NEW YORK, March 2—Members of the National Automobile Chamber of Commerce met here to-day to discuss problems of importance to the industry. One of the most important was the used car situation. Several specific remedies were proposed.

One of the most comprehensive was presented through C. C. Hanch by Homer McKee of Indianapolis. It would provide for certified dealers who would be given certificates stating that they had agreed to put all used cars in such condition that they could be sold as certified cars. Under the plan a committee of manufacturers would be appointed to pass on rules under which the certified dealers would operate. There also would be a committee of four dealers in each locality, three of whom would not be interested in the car passed upon, who would be called upon to inspect each vehicle before it was offered for sale.

Advertising Values Favored

It developed at the meeting that there is opposition to attempts by factories to recondition their own product although the idea of having dealers do so is generally supported. Used car exchanges are favored, but some doubt was expressed of their success. General approval was given to the proposal to have factories advertise the values of old models.

Both manufacturers and dealers favor co-operative used car advertising, selling cars with a guaranty and used car shows. Appraisals by individual companies in each locality are favored.

The directors were supplied with a mass of information on the used car question provided by questionnaires sent to 2500 representative dealers. Reports from practically every section of the country were that there has been a marked improvement in the demand for used cars and that the shrinkage in the number on hand has been rapid in the past two or three months. Nowhere is the used car problem more acute.

A survey of trade conditions presented to the directors of the N. A. C. C. at their monthly meeting yesterday showed that sales were considerably better for February than for January, while March and April prospects are much better. Generally speaking, credits for dealers are much easier, particularly on the Pacific Coast. Truck sales also are picking up.

Gasoline Taxes Taken Up

The directors discussed at length the effort being made by various state legislatures to impose taxes on gasoline. It was the general feeling that a gasoline tax is not proper unless it takes the place of other fees.

The directors decided to adopt a standard safety code to be supplied motor car purchasers with their instruction books. Motor car operators will be told that they are engineers and that they have all the responsibilities of engineers.

A committee will be appointed to work with the Bureau of Simplified Practice of the Department of Commerce in standardization work as it relates to the elimination of needless sizes.

United Auto Stores Put in Receivership

(Continued from page 534)

concern has a fiscal office, and in West Chester, where there is a branch store, are reported to be many.

The petitioners in their prayer aver that to the best of their information and belief the contracts and transactions between the Stores company and the Guaranty company are void and fraudulent, and a temporary injunction is asked to restrain the further sale of stock and an injunction to prevent the distribution of any cash or property of the Stores company.

The court is asked to have the Guaranty company take all cash and other assets of the Stores company and make a complete accounting.

Well known Philadelphians were on the directorate of the Stores company as Carrier insisted on "minimizing risk" by strictly localizing each unit of the organization and establishing the policy that the manager and assistant manager of every branch must be stockholders. Many of the directors resigned last summer. The present directors are Carrier, president; H. J. Stokes, vice-president; Harry G. Coxe, treasurer; Rubens H. Peale, chairman of the finance committee of a bank in Schuylkill Haven, Pa.; M. H. Fox and W. A. Beisacher.

Gray Plans Unchanged by Durant \$348 Car

DETROIT, March 1—President Frank L. Klingensmith of the Gray Motors Corp. said to-day that the plans of that company would not be changed in any way by the production of a \$348 car by W. C. Durant. Practically all the equipment for the manufacture of the Gray car is now ready, and it is expected shipments will start about April 10. The price will be announced before that time.

"There is room for a number of manufacturers in the low priced field," Klingensmith said, "and we are looking for about 10 per cent of the business."

NO CHRYSLER ANNOUNCEMENT

NEW YORK, March 1—Walter P. Chrysler has not yet made any announcement of his plans for the future. He left last week for Palm Beach. W. C. Durant also is at the Florida resort. It is not considered probable, however, that Chrysler will join forces with Durant Motors.

Notes Are Renewed for Willys-Overland

Defeat Seen for Bank Creditors— No Mortgage on Property Now Likely

(Continued from page 532)

TOLEDO, Feb. 24—Charles B. Wilson was elected vice-president and general manager of the Willys-Overland Co. at the meeting of directors to-day. Two of the former Willys directors were also displaced by two more Toledo business men. William W. Knight of the Boswick Braun Co., a director also of the Fourth Federal Reserve Bank, Cleveland, replaces George W. Spencer, who resigned as secretary of the board.

Charles E. Bunting, president of the Bunting Brass & Bronze Co., replaces James E. Kepperly as a director.

Linwood A. Miller, who has been assistant to Vice-President Wilson, has been elected secretary to the company.

Together with Henry L. Thompson, W. L. Milner, George M. Jones and Gordon M. Mather, named last week, this new board will have nine of its eleven members representing Toledo banks and business interests.

Suit Filed Against Overland

TOLEDO, Feb. 27—An echo of the reduction of commitments from \$46,000,000 in the spring of 1920 to about \$19,000,000 at the close of 1921 came last week in the filing of a suit for \$257,482 against the Willys-Overland Co. by the Dura Mechanics Hardware Co., a Toledo corporation.

Alleged failure on the part of the Overland to comply with an agreement and accept a number of window lifters, an automobile accessory, is given as the cause for the action in the petition.

The suit is filed in Common Pleas Court of Lucas County.

Willys Corp. Receivers Combat State

TOLEDO, Feb. 27—Receivers for the Willys Corp. have asked Judge Killits here for authority to combat the State of Ohio on the matter of an annual assessment against the corporation which, they allege, is levied and collected under a statute that is unconstitutional.

The claim of the State against the company is for \$89,556.40.

The receivers want an injunction or restraining order against the State officials to prevent any action now to collect \$77,875.13 of actual fee and \$11,681.27 which is a 15 per cent penalty.

RUBBER FROM ISOPRENE

BEAUMONT, TEXAS, Feb. 27—It is now practical to manufacture artificial rubber from isoprene, a recently discovered product of petroleum, according to J. W. Newton, petroleum engineer and assistant superintendent of the local refinery of the Magnolia Petroleum Co.

2047 Cars Exported, G. M. Shipments High

Corporation Sent from Its Plants
in Canada More Than 1200
Automobiles in January

NEW YORK, March 1—Export shipments by the General Motors Corp. from its Canadian plants to all parts of the world except England totalled 736 motor cars during January. This was announced to-day by the General Motors Export Co., following the issuance in Washington of the January shipments from the United States.

Additional shipments from Canadian plants to England, not included in the figure of 736, for sale in the British Isles were between 500 and 600, the exact number not being available here. None of these exports shows in the figures published at Washington yesterday. Thus, the General Motors shipments during January were from 1200 to 1300 cars, as compared with declared shipments from the United States of 2047.

The destination of the Canadian exports was announced as being Australia, Argentina, Brazil, India, South America, Mexico, some parts of Continental Europe and various countries of Latin-America. In December General Motors shipped 1338 cars from Canada, as compared with the declared exports from the United States for that month of 2652.

WASHINGTON, Feb. 28—The international shipment of American made automotive equipment continued throughout January at practically the same levels set in the closing months of 1921, when the impetus of new buying was begun as a result of the liquidation of overseas stocks. In announcing the January export totals to-day the Bureau of Foreign and Domestic Commerce instituted new classifications that have been so long desired by exporters.

The totals on the major items were as follows:

	January	December
Pass. cars.. (2047)	\$2,025,974 (2646)	\$2,349,282
Com. Vehicles (464)	461,193 (511)	461,193
Parts, not including engines and tires	2,061,619	2,683,850
Tires, automobile only	1,412,602	1,391,635

The chief interest that will attach to these figures, in view of the fact that one of the largest producers, General Motors, has diverted its export shipments to Canada and that these do not appear in the United States totals given here, is in the classification of the different price and tonnage ranges of passenger cars and motor trucks. These are given in an adjoining table, but in

Exports, Imports and Reimports of Automotive Products for January, 1921 and 1922, and for Seven Months That Preceded

	Month of January		Month of January		7 Months Ending Jan. 31		7 Months Ending Jan. 31	
	No.	Value	No.	Value	No.	Value	No.	Value
	1921	1922	1921	1922	1921	1922	1921	1922
Automobiles, including chassis.....	7,378	\$9,409,920	2,997	\$2,528,292	87,411	\$114,855,029	19,332	\$17,544,094
Electric trucks and passenger cars.....			26	41,125			26	41,125
Motor trucks and buses, except electric.....	1,539	2,516,379			14,404	24,543,664	2,727	2,851,223
Up to one ton.....			222	114,067			222	114,067
Over 1 and up to 2½ ton.....			220	287,531			220	287,531
Over 2½ ton.....			22	59,595			22	59,595
Total motor trucks and buses, except electric.....	1,559	2,216,379	464	461,193	14,404	24,543,664	3,191	3,312,416
PASSENGER CARS								
Passenger cars, except electric.....	5,819	\$6,893,541			73,007	\$90,311,365	13,708	\$12,164,576
Valued up to \$800.....			1,330	\$691,065			13,330	691,065
Valued over \$800 and up to \$2,000.....			994	1,055,879			994	1,055,879
Valued over \$2,000.....			83	279,030			83	279,030
Total passenger cars, except electric.....	5,819	6,893,541	2,407	2,025,974	73,007	90,311,365	16,115	14,190,553
PARTS, ETC.								
Parts, except engines and tires.....		Lbs.						
Station and warehouse motor trucks.....	98	81,699	6	7,590	408	233,772	69	76,749
Trailers.....			33	21,003			33	21,003
Airplanes and Sea-planes.....	17	114,775	1	5,000	53	386,955	19	126,165
Parts of airplanes, except engines and tires.....								
		24,999	47,374	11,479		108,310		57,958
BICYCLES, ETC.								
Bicycles and Tricycles.....		\$533,967	69	\$9,460		\$2,907,056		\$424,519
Motorcycles.....	4,322	1,473,390	1,010	284,883	20,870	6,529,061	4,054	1,127,415
Parts, except tires.....			229,918	131,677			229,918	131,677
Gas engines.....	148	48,734	172	36,494	2,507	460,342	799	167,128
Traction engines, except agricultural.....	44	60,532	1	2,425	250	440,611	10	27,252
Automobile engines.....	231	65,691	1,182	143,397	9,007	1,641,046	5,417	877,069
Aircraft engines.....			3	5,275			3	5,275
Complete tractors, except agricultural.....	2,513	2,866,172	2	8,851	17,436	17,085,020	135	205,718
Other internal combustion engines.....	1,741	334,697	383	29,551	10,566	1,581,000	2,761	380,279
Accessories, parts.....	490	375,176			4,571	2,835,111	631	688,472
IMPORTS								
Automobiles.....	54	\$64,653	36	\$62,543	860	\$905,093	313	\$485,038
Parts, except tires.....		93,841		60,307		860,122		346,779
All other.....		12,428		4,955		380,931		87,428
RE-IMPORTS								
Automobiles (free of duty).....	62	\$90,258	137	\$254,835	2,132	\$3,223,888	2,089	\$3,188,002

recapitulating them, it is shown that the medium priced car class by far outranks in value either the lower or the higher priced categories and that the medium sized truck also held the center of the stage. This will be received with a distinct surprise by those executives of the industry who have held that the low-priced cars and the low capacity trucks were taking all of the present foreign business.

Passenger car exports are shown in three classifications, those valued at less than \$800, between \$800 and \$2,000 and in excess of \$2,000. The first classification shows 1330 cars valued at \$691,065, the second 994 cars valued at \$1,055,879, and the third 83 cars worth \$279,030. Thus, the medium priced cars were something like a third less in number than of the low-priced class, but something more than 50 per cent greater in value. The cars included in these classifications will be readily comprehended, but it must be remembered that the declared valuation applying here represents the dealer's price, with discount

and, in some cases, chassis price only.

The truck classifications likewise are three, up to 1 ton, from 1 ton to 2½ tons and above the latter figure. The export statistics show 222 of the 1 tonners, with a valuation of \$114,067, against 220 of the medium sized models with a value of \$287,531. The higher capacity trucks were 22 in number, valued at \$59,595.

Throughout the export figures there will be seen the result of the new classifications that have been put into effect by the reorganized Bureau of Foreign and Domestic Commerce, with its new commodity divisions. These classifications are shown in a table herewith, excepting for tires. An advance statement, however, on the tire exports shows the January shipments to have been as follows:

	No.	Value
Automobile casings.....	80,511	\$1,148,616
Other casings.....	1,577	4,875
Automobile tubes.....	48,935	116,385
Other tubes.....	1,134	1,158
Automobile solid tires.....	3,890	147,601
Other solid tires.....	22,610	8,231
Tire repair material.....		10,293

MEN OF THE INDUSTRY

Major Mark L. Ireland has been detailed by the Secretary of War to represent the army on the technical committee of the Lincoln Highway Association to determine the design for the Ideal Section, which the association will construct this year for object lesson purposes. Major Ireland is a director of the Tractive Resistance of Roads Research being conducted by the army with the aid of the Massachusetts Institute of Technology, at Cambridge, Mass.

William E. Betts has been made advertising manager of the Studebaker Corp. He was formerly engaged in advertising and sales promotion work for Willys-Overland and the Overland Harper Co. of Philadelphia. He goes to Studebaker from the Olds Motor Works, where he was engaged in special sales promotion work.

Guthrie Shaw has been appointed manager of the Accessory Products Corp., now located in its new headquarters, 519 West Twenty-third Street, New York City. The company has been appointed metropolitan distributor for genuine replacement parts of the Arvac Manufacturing Co., the Oakes Co. and the A. J. Detlaff Co.

Henry Harnischfeger, one of the founders and president of Pawling & Harnischfeger Co., Milwaukee, and also head of the Associated Machinery Corp., has left with his wife for a trip around the world, and will be gone from six to eight months. He will visit branch offices and look over general business conditions.

Charles Hughes Connelly, formerly western sales manager of the Miller Rubber Co., has been appointed general sales manager of the Carlisle Tire Corp. He has had fifteen years' experience in factory work and the merchandising of tires. His headquarters will be at the company's general office at Stamford, Conn.

Fred D. Williams has been appointed assistant to President John S. Broughton of the United & Globe Rubber Co. Williams has been general manager of the L. H. Gilmer Co. of Philadelphia for the last three years and prior to that was associated with the Johns-Manville Co. and the U. S. Rubber Co.

William G. Brown has been appointed general sales manager of the A. H. Petersen Manufacturing Co., Milwaukee. For the last eight years Brown has been with the American Bosch Magneto Corp. and resigned as western manager, with headquarters at Chicago, to take up this new connection.

Paul L. Battey, formerly vice-president of the Arnold Co., Chicago, and for years chief engineer in charge of various industrial enterprises, including the Willys Corp. plant at Elizabeth, has established himself at 123 West Madison Street, Chicago, as consulting engineer for industrial plants.

Harrison H. Boyce, general manager of the Moto-Meter Co., Inc., and E. V. Hennecke, sales manager, are making a tour of the country investigating trade conditions in the automotive accessory field. The investigation will extend over a period of approximately two months.

B. F. Metcalf has resigned as employment manager for R. & V. Motor Co., East Moline, and will leave in a few days to take up duties in Mexico in connection with the Rockefeller Foundation, with headquarters in Vera Cruz. Metcalf has been associated with R. & V. Motors for six years.

Frank S. Bradley, formerly secretary and general manager of the West Haven Man-

ufacturing Co. since its inception in 1896, has accepted the management of the Robert Manufacturing Co., New Haven, Conn., as its president.

J. F. Kelly, Jr., export sales manager of the Electric Storage Battery Co., Philadelphia, is now on his way to Mexico, where he will remain for a month, visiting the automobile show and returning by way of Cuba.

Albert Hirst, Inc., has given up his Ford agency in New York City to become distributor of the Gray car. His territory includes the states of New York, New Jersey, Connecticut and Rhode Island.

John McConnell has again affiliated himself with the United Alloy Steel Corp. as vice-president in charge of operation. He has been associated with the steel industry for a number of years.

C. H. Tyler has been appointed district sales supervisor of Earl Motors, Inc., with headquarters at Indianapolis. He has had eighteen years' experience in the automobile business.

A. M. Leoni, who until recently was connected with the Steinmetz Electric Car Co. of Baltimore, has joined the Electrocar Corp. of New York as consulting mechanical engineer.

Lake Jones has been appointed district manager of the southeastern territory for the Ajax Rubber Co., Inc. His headquarters will be in Atlanta.

January Output Reached 90,486, Including Ford

NEW YORK, March 2—Production of passenger cars and trucks in the United States for January aggregated 90,486, including Ford. The total for December was 78,995 and for November was 116,349. The relative gain over December for January by manufacturers excluding Ford was 40 per cent on passenger cars and 38½ per cent on trucks. Ford's relative gain for January over December was considerably below this figure.

There are no production figures for January, 1921, with which to make comparisons, but the output this year was much larger than for the same month last year. Most of the increase for January over the preceding month was in passenger cars ranging in price from \$500 to \$1,250.

Canadian Plant of Durant Motors Turns Out First Car

NEW YORK, March 1—The first car was turned out to-day in the plant of Durant Motors of Canada, Ltd. When W. C. Durant announced on Sept. 2 that he had purchased the munitions plant at Leaside, near Toronto, he promised that it would be in production by March 1 and operations have been begun exactly on schedule. The Canadian plant makes the fourth Durant factory now in production. The others are at Long Island City, Lansing and Muncie. All of them are working up to quantity production.

No announcement has been made yet as to where Durant will produce the new \$348 car he is to manufacture for a group of parts makers, but it is probable they will be produced at first in one of his present plants, probably that at Long Island City.

Pierce-Arrow Lost \$8,763,712 in 1921

Balance Sheet Shows Net Current
Assets of \$13,651,323; Liabilities
\$8,665,522

NEW YORK, March 2—A total loss of \$8,763,712 for the year 1921 is reported by the Pierce-Arrow Motor Car Co. after all interest charges, depreciation, inventory adjustments and operating expenses. As a result the balance sheet on Dec. 31, 1921, showed a profit and loss depreciation of \$4,422,165 against a profit and loss surplus of \$4,541,646 at the end of the previous year.

The general balance sheet shows net current assets of \$13,651,323 against \$19,754,535 in 1920 and net current liabilities of \$8,665,522 against \$7,332,138. The current assets on Dec. 31 last were divided as follows: inventory \$11,246,697, receivables \$1,930,662, cash \$473,963. The current assets for Dec. 31, 1921, were: Inventories \$1,647,662, receivables \$195,773, cash \$1,338,100.

The current liabilities for 1921 were: notes payable \$7,150,000, accounts payable \$1,393,322, dealers deposits \$122,200, making a total of \$8,665,522. For 1920 the current liabilities were: notes payable \$5,750,000, accounts payable \$1,450,538, dealers deposits \$131,600, making a total of \$7,332,138.

Lincoln Places \$1,000,000 Order with Body Company

BUFFALO, Feb. 24—The Lincoln Motor Co. has awarded to the American Body Co. of this city a million-dollar contract for the construction of bodies for its new four and seven passenger cars.

Filling of the contract is expected to take at least six months. The work will call for an additional force of about 300 expert body builders. The Buffalo plant is at present working on the first lot of orders.

The product manufactured by the body company will consist of the body enameled, upholstered and equipped ready for attaching to the chassis.

Liberty Motor Creditors Agree to an Extension

DETROIT, March 2—Bank and merchandise creditors of the Liberty Motor Car Co. have agreed to an extension of credit and the company has obtained \$300,000 new money by giving a mortgage on its real estate and equipment. The new funds will be used to develop a popular priced model to pay off small creditors and further liquidate inventories.

In the 18 months preceding Dec. 1, 1921, the company reduced its bank loans by \$333,975 and paid merchandise bills amounting to \$434,973. President Owen states that sales now are ahead of production. The creditors who entered into an extension agreement have appointed an advisory committee through which it is hoped to obtain additional permanent capital.

FINANCIAL NOTES

India Tire & Rubber Co. reports that during 1921 without refinancing in any way and without issuing new stock the company materially reduced its bank loans, wrote off losses on raw materials and finished merchandise on hand exceeding \$400,000 and greatly improved its financial position. D. A. Grubb, secretary and general sales manager, states that the company now has 340 per cent more new accounts than the year before and that compared with the half of 1920, sales from July to January in 1921 show an increase of 130 per cent, while the value of the December business was the largest in the history of the company, being 181 per cent larger than the same month the previous year.

Motor Wheel Corp. operating profits for the year ended Dec. 31, 1921, were \$599,590. The company has \$1,058,807 cash with total current assets of \$3,752,105. Current liabilities aggregate \$278,691. Inventories have been depreciated \$266,249. With reductions for inventory deflation and Federal taxes the net profit for 1921 is \$301,340. Preferred stock of \$75,000 has been retired and additional purchases have been made from the sinking fund on the open market of \$169,000, beside the purchase of a small amount of common stock. New business on the books is reported as the largest in the company's history.

Edmunds & Jones Corp., in its balance sheet as of Dec. 31, shows total assets of \$1,995,582.28 and a surplus of \$1,046,466.29. Assets include cash, \$293,272.21; accounts and notes receivable, \$203,906.48; inventories, \$455,783.63. Plant accounts, less depreciation, are \$967,996.92. Profits for 1921, less Federal taxes, are \$97,580.79. Dividends paid on the preferred stock in the four quarters totaled \$53,219. In a report to stockholders, President Edmunds states that despite heavy losses in the first six months of the year due to inventory inflation, the net profit for the year approximates that for 1920.

S. F. Bowser & Co., Inc., Fort Wayne, Ind., announces that forty-six executives are to be allotted portions of the common treasury stock of the company in a total amount close to \$500,000. It is the plan to permit key men in the organization to purchase this stock on a basis that will enable them to pay for it easily in the next few years. S. F. Bowser and Allan A. Bowser who have held the greater part of the stock for years are releasing it in this manner as a reward for good service and to stimulate the men's interest in the business.

Republic Rubber Corp. operating costs have been greatly reduced, according to Receiver G. H. Booth. He states that important distributing connections are being made despite the sentimental handicap of the receivership and forecasts an increased volume of business which will make the company show an operating profit. The company is said to be employing 1,000 men.

Mason Tire & Rubber Co., Akron, reports sales of \$8,986,000 for the 14 months ended Dec. 31, 1921. Current assets as of Dec. 31 are placed at \$2,675,606; current liabilities, \$859,863; surplus account, \$11,139; inventory, \$1,363,458. Cash account is stated to be \$240,000; accounts and notes receivable, \$1,071,767; notes payable, \$774,613; reserves, \$115,882.

Timken-Detroit Axle Co. has declared a regular quarterly dividend of 1½ per cent on preferred stock, payable March 1, to stockholders of record Feb. 20. Resumption of

Hays Endorses Wells'
Transportation View

WASHINGTON, Feb. 27—The time is not far distant when motor vehicle transportation will be universally recognized, in the opinion of Will H. Hays, postmaster general. His belief is expressed in the following statement:—

"A little while ago I read an article by H. G. Wells that I wish might be read by every business man; in fact it could be read with advantage in every school house in America. Wells traced the development of civilization to two factors, transportation and communication. These have been the vital factors that have enabled human beings to develop so marvelously and so rapidly in the last few hundred years.

"The Post Office Department is the government department of communications. We are all glad and proud to be associated with one of the vital factors in civilization. But we also touch upon transportation, and I look forward to a time not far distant when motor vehicle transportation will be universally recognized as one of the vital factors in the development of civilization."

common dividends was considered, but action was temporarily postponed.

Advance Rumely Thresher Co. has declared a regular quarterly dividend of 75 cents on the preferred stock, payable April 1, to stock of record March 15.

Goodyear Tire & Rubber Co.'s income account for the eight months ended Oct. 31, 1921, shows net profits after all charges of \$3,273,845.

AUSTIN OUTLOOK GOOD

LONDON, Feb. 17 (*By Mail*)—In a circular letter to shareholders of the Austin Motor Co., Birmingham, England, the chairman, Sir Herbert Austin, announced that the necessary agreements have been reached with bankers, creditors and the Government to a plan which provides sufficient working capital for carrying on the business successfully. It is stated that the prospects at the present time are very encouraging and the contracts entered into for the home market total well over £3,000,000.

U. S. TRACTOR BOND ISSUE

MENASHA, WIS., March 1—A bond issue of \$250,000 was decided upon at the annual meeting of the United States Tractor & Machinery Co. and the capital was increased to \$2,500,000. The bond issue, it is stated, is to provide for an immediate increase in factory capacity and equipment. J. M. Robinson was re-elected president of the company and G. D. Harris vice-president and general manager.

BANK CREDITS

Written exclusively for AUTOMOTIVE INDUSTRIES by the Guaranty Trust Co., second largest bank in America.

During the past week call money rates ranged from 4 per cent to 6 per cent, as compared with 4 per cent and 5 per cent in the previous week. Funds were in fair supply and brief periods of flurry, due mainly to withdrawals by out-of-town institutions, were succeeded by a firmness which developed toward the latter part of the week. In the time money market the rates ranged from 4½ per cent to 5 per cent for all maturities from 60 days to 6 months. The rates for prime commercial paper remained unchanged at 4½ per cent to 5 per cent.

The Federal Reserve statement as of Feb. 21 showed an increase of \$4,900,000 in total reserves, which was the net result of an increase of \$10,780,000 in gold reserves and a decrease of \$5,880,000 in other reserves. Total earning assets showed an increase of \$89,652,000, while total deposits decreased \$85,293,000. Federal Reserve notes in circulation increased \$3,561,000, while the reserve ratio also increased from 76.4 per cent to 78.1 per cent.

The total reserves of the New York institution declined \$43,429,000. Other decreases noted were the following: \$36,086,000 in total bills on hand; \$74,522,000 in earning assets; \$34,662,000 in total deposits. Federal Reserve notes in circulation, on the other hand, increased \$4,753,000, and the ratio of total reserves to deposit and Federal Reserve note liabilities combined increased from 81.9 per cent to 87.1 per cent.

On Feb. 27, sterling exchange at \$4.43½ reached a new high record for the upward movement which has been in progress for some weeks. On Feb. 28 the discount on Canadian funds was only 2 per cent, which was a new low and marks an approach toward normal.

According to the Bureau of Labor Statistics index number, wholesale commodity prices for the month of January declined 7/10 of one per cent, as compared with no changes a month ago. With the exception of farm products, which showed a small gain, every group of commodities showed some recession. The general level still stands 48 per cent above the level for 1913, although it is approximately 45 per cent below the peak reached in the spring of 1920.

WILLS MAKE NEW CLOSED BODIES

MARYSVILLE, MICH., Feb. 27—C. H. Wills & Co. is now in production on three new closed bodies for the Wills Sainte Claire line, these being an imperial sedan, a town car and a limousine. The sedan is \$3,575, and the town car and limousine, \$3,850. The sedan has features of both a limousine and a sedan, having a glass partition which can be raised or lowered to divide the car into compartments. The limousine and town car have the same dimensions as the sedan, except that the space between seats varies.

INDUSTRIAL NOTES

Auto Body Co. has recently increased operations at its plant in Lansing, due to a contract with Durant Motors for open car bodies. January production was 85 per cent more than January, 1921. About 400 men of a normal force of 1000 are working. W. V. C. Jackson, vice-president, reports the company's indebtedness reduced greatly during the year.

Motor Wheel Corp. will open a Detroit office with M. W. Taber special representative in charge. R. I. Miner, in charge of the pressed steel division activities in Detroit, will occupy the same office. Taber's duties include the handling of both the manufacturers and distributor's end of the work. For the last year he has been in charge of steel wheel distribution in the Michigan territory.

American Brass Co., Kenosha, Wis., works, now owned by the Anaconda Copper Co., will add a new department for producing fine copper wire. The Kenosha branch has available a large group of buildings adjoining the main plant and formerly owned by another industry which is readily convertible for the wire mill.

Buckeye Manufacturing Co.'s plant and equipment at Anderson, Ind., has been sold at receiver's sale to James W. Sansberry, a local banker, for \$45,100. The property was appraised at \$170,000. The company formerly made automobiles, tractors and engines. The liabilities of the concern are said to approximate \$200,000.

Rainbow Tire & Rubber Co., Delaware, Ohio, reports that, at the present rate of financing, production should start within the next few months. The factory is practically completed at a cost of \$175,000 and is free from indebtedness. All directors were re-elected at the annual meeting.

Franklin Automobile Co.'s report to the Federal authorities shows that the number of employees who earned \$1,000 or more during 1921 was only 10 per cent less than the number who earned that amount during 1920.

Visible Pump Co., Fort Wayne, Ind., which is moving to Findlay, Ohio, has leased the former property of the Grant Motor Co. in that city and will begin operations there within a month.

Aehtabula Tire & Rubber Co. has purchased the plant erected by the Pierce Tire & Rubber Co. at Niles, Ohio, some years ago and will rehabilitate it for operations not later than March 15.

Kirkland Bros. Machine Co., Detroit, has organized a company of the same name in Springfield, Mass., to act as a factory branch. Incorporation is for \$250,000.

Storm King Manufacturing Co. has moved its factory equipment and offices from Winneconne, Wis., to Hortonville, Wis.

American Bushings Co., Marysville, Mich., is operating with two shifts, due to the receipt of a large volume of orders.

India Tire & Rubber Co. has established a branch warehouse at 250 West 54th Street, New York City.

DUAL TRACTOR PLANT SOLD

DECATUR, ILL., Feb. 27—Bondholders of the defunct Dual Tractor & Truck Co. have purchased the company's plant and have changed the name to the Decatur Machine & Specialty Co. A charter has been granted by the secretary of

Argentina Harvest
Returns Satisfactory

BUENOS AIRES, ARGENTINA, Jan. 17 (by mail)—Returns from the present harvest are quite satisfactory and the demand for wheat seems more active. This also applies to livestock, and the sales of wools and hides have almost reached a normal volume. The tendency is upward, and each week sees further advances.

Most car stocks have been liquidated, and new orders will be required commensurate with present day requirement. The truck market, however, remains dull, but tires and tubes are more active than for many months past, especially in the smaller sizes.

The belief is that within a few months the present progress of Argentina on the road to recovery will be speeded up considerably, and that by the latter part or end of 1922, business will again be booming.

state to operate a machine shop with the capital stock fixed at \$50,000. All bondholders of the old company were given the privilege of exchanging their claims against the old company for stock in the new. Most of them accepted the offer and the plant has been re-opened. It will specialize in motor vehicle work of a special or engineering type.

Studebaker Denies Report
of London Factory Branch

SOUTH BEND, IND., Feb. 28—In the absence of President A. R. Erskine, N. R. Feltes, treasurer of the Studebaker Corp., declares there is no truth in the rumor that the corporation is negotiating for the purchase of the Ensign car factory near London, England, to be used as a factory branch.

Report from London

LONDON, Feb. 14 (By Mail)—The Studebaker Corp. is reported to have bought the recently built Ensign car factory at Willesden Green, London, N.W. It is stated that it is not intended to assemble cars at this plant but to use the facilities available for repairing and distributing Studebaker products. At the same time the company, it is said, will continue to occupy its present showroom on Gt. Portland Street.

HANSON ABSORBS COMPANY

ATLANTA, March 1—George W. Hanson, president of the Hanson Motor Co., announces that the company has absorbed the American Motors Export Co. of Jacksonville, Fla., and that the two industries have been merged. The joint company, which is to be known in future as the Hanson Motors Co., will maintain headquarters in Atlanta and also operate a plant at Jacksonville.

METAL MARKETS

ONCE more steel mill operations have attained a rate which, if it can be slightly enhanced, will permit of reductions in the cost of production that should enable the majority of mills to make a fair profit at prevailing market levels. It is axiomatic of most steel mills that when three-fifths of their capacity is engaged in production the balance will come out on the right side of the ledger. Sheet mills are operating at a rate of two-thirds to three-quarters of capacity, in some instances even higher. The leading interest is reported to be operating at 70 per cent of the capacity of its sheet mills.

Taking the industry as a whole, however, it is operating at somewhere between one-half and two-thirds of its capacity and the goal of those mills which are now turning out slightly more than one-half of what they could produce, if their entire capacity were engaged, is to get enough orders on their books to permit of operating their plants at three-fifths of their capacity. Amid this intensive effort to speed up the momentum of the demand upward changes in prices would defeat their own purpose, while reductions would upset the ultimate aim of producers; i.e., modest profits based on the prevailing market.

Individual concessions of a minor character, when specifications are attractive, fit, however, very nicely into this scheme of things. Here and there buyers have voiced uneasiness because of the recent advance in the pig iron quotations of some of the larger interests. In a large measure this attempt to lift the pig iron market to a higher level was the result of increased demand for steel. As a direct consequence of this latter condition steel mills are now working up all of their pig iron production, whereas up to a short time ago they competed for business with the merchant furnaces. The latest market letters of the leading pig iron sellers paint a glowing picture of the better feeling that has come over the market. Undoubtedly there has been a perfectly natural increase in the demand concurrent with the increased melt by foundries.

Pig Iron.—Thousand-ton sales to automotive foundries are few and far between. Those that have been made carried prices somewhere between the old and new asking prices. Most of the automotive buying is in carloads.

Steel.—As the result of improved automotive demand, alloy steel producers are operating on a much more satisfactory basis. Demand for skelp for automotive purposes had broadened impressively, a Detroit interest being reported to be in the market for a large tonnage of strip skelp. Some sales of sheet bars at \$29 appear to have been made recently. Very little change is to be noted in the sheet situation, prices holding steady with slightly less fresh business in full-finished automobile sheets. Automotive interests are placing more liberal orders for forging bars, and cold-drawn steel bars continue in active demand. Pittsburgh strip steel producers report sales of attractive tonnages to automotive interests. There has also been a slight revival in automotive demand for bolts and nuts.

Aluminum.—While the sheet market is fairly steady that for virgin ingots, 98 to 99 per cent pure is still debatable ground, with odd lots of imported metal changing hands at slight concessions from prevailing quotations.

Copper.—The market continues weak.

Calendar

SHOWS

April 3-16—New York, Second Annual Electric Automobile Show, Showroom of the New York Edison Co.
May 24-June 5—Barcelona, Spain, Automobile Show under Dealers' Direction.

FOREIGN SHOWS

March, 1922—Santiago, Chili, Annual Automobile Show.
April 16-23—Mexico City, Annual Automobile Show, Auspices of the Automotive Division of the American Chamber of Commerce.
April 22-May 1—Prague, Czecho-Slovakia, Fourteenth International Automobile Exhibition.
May—Shanghai, Exhibition of Road Building Material.

May, 1922—Quito, Ecuador, Agricultural Exposition, celebrating Centenary of Ecuador. Automotive Section.

May 1-15—The Hague, Automobile Show, also Airplanes and Motorboats. Secretary, Spui 185, The Hague.

May 6-21—Scheveningen, Automobile Show.

May 28-June 5—Prague, Motor Show, Hotel de Ville.

July 1-24—London (Olympia), Aircraft Exhibition.

Sept. 1922—Rio de Janeiro, Brazil, Automobile exhibition in connection with the Brazilian Centenary Association Automobillista Brasileira.

Sept. 15-20—The Hague, Automobile Show.

Oct. 12-23—London (Olympia), International Commercial Vehicle Exhibition.

November—London (Olympia), Automobile Show.

Nov. 10-Dec. 19—Brussels, Automobile Show, Palais de la Cinquantenaire.

Nov. 29-Dec. 4—London (Olympia), Cycle and Motorcycle Show, British Cycle Motors, The Tower, Warwick Road, Coventry.

CONVENTIONS

May 10-12—Philadelphia, Ninth National Foreign Trade Convention of the National Foreign Trade Council.

May 16-18—Washington, D. C., Annual Meeting of the Chamber of Commerce of the United States.

June 11-15—Milwaukee, Annual International Convention of the Associated Advertising Clubs of the World.

June 26-July 1—Atlantic City, Twenty-fifth Annual Meeting of the American Society for Testing Materials, Chalfonte-Haddon Hall Hotel.

August 28-Sept. 2—Detroit, National Safety Congress.
Sept. 18-22, 1922—Rome, Italy, Second Annual Meeting of the International Chamber of Commerce.

S. A. E. MEETINGS

Detroit, Mar. 24, April 28, May 26.

June 20-24—White Sulphur Springs, W. Va., 1922 Summer meeting of Society of Automotive Engineers.

Kansas Sales Pivot Is Small Town Bank

Public Wants to Buy, Credit Is Ample, But Financiers Halt Procession

KANSAS CITY, MO., Feb. 27—The public wants cars and is ready to buy them. The dealers are ready to sell them. Credit facilities are ample. The bankers in smaller towns stop the procession.

Therefore, the chief effort of many distributors here is to see that bankers adjust themselves to the other conditions—and let dealers and public have money for cars.

The campaign to sell the idea of motor cars to bankers is not confined to this personal contact of travelers and dealers with bankers. The distributor himself keeps in close touch with each of the bankers in his dealers' towns. The wholesale manager himself knows most of them and sends letters to them occasionally.

One type of letter has proved of very great value. This is the letter announcing new developments in the motor car field; sometimes a factory circular letter with appended note from distributor, sometimes a personal letter from the distributor giving or calling attention to the information. In this way the banker is kept posted on the industry; and when dealer or traveler makes some statement the banker knows what he is talking about and responds the more cordially.

Cleveland Business Men Interested in "Glenwood"

CLEVELAND, Feb. 27—Most of the officials of the Glenwood Motor Car Co., which has purchased a fifteen acre tract at Youngstown on which will be erected a factory for the production of a car to be known as the "Glenwood," are Cleveland business men.

B. J. Cline of this city is president of the corporation. He was associated with the Pierce-Arrow Motor Car Co. at one

time and later was production manager for the Chandler Motor Car Co. During the war he served with the Aircraft Board. T. D. Lamb, president of the Hess Body Co., is treasurer; Captain R. L. Queisser of R. L. Queisser Co., is secretary, and William H. Graham, a florist, is a director.

The Glenwood company is a \$5,000,000 corporation with 50,000 shares, \$100 each, of preferred stock and 200,000 shares of no par common. The company has under control an engine which has developed what is said to be unusual power, but, for the present, Cline has no announcements to make about the car.

McDonald Is Honor Guest at N. A. C. C. Road Dinner

NEW YORK, March 2—Thomas McDonald, chief of the Bureau of Public Roads, was the guest of honor at a dinner given by the Highways Committee of the National Automobile Chamber of Commerce at the Hotel Ambassador last night. Most of the guests were representatives of newspapers, trade and business papers.

The purpose of the meeting was to discuss the present status of highways in the United States and to enlist widespread co-operation in highway construction and maintenance work which will be carried on in the next few years. Edward F. Jordan, president of the Jordan Motor Car Co., president. George M. Graham, vice-president of the Chandler Motor Car Co., emphasized the essential character of motor vehicles.

FORD BUILDING 3400 DAILY

DETROIT, March 2—The Ford Motor Co. is operating at the rate of 3400 cars a day on a four day a week schedule. The March schedule calls for between 60,000 and 65,000 cars.

PAYS JACKSON CREDITORS

NEW YORK, March 2—Associated Motor Industries, Inc., has made a small payment to the creditors of the Jackson Motors Corp., which was taken over a few months ago by the Delaware corporation as part of a proposed automotive merger.

Clouds Overhanging Iowa Start to Break

Improvement in General Business Conditions Reflected in Outlook of Trade

DES MOINES, Feb. 27—There is a break in the rather dark cloud which has hung over the motor car horizon in Iowa during the past year. The month of February sees the most cheerful outlook which Des Moines dealers and distributors have encountered in many a moon, and there is evidence that at last the corner has been turned and that business conditions are on the upgrade.

As a concrete evidence of the improvement, it is noted that in the first fifteen days of February 102 new passenger cars were registered with the state automobile department for Polk county, in which Des Moines is located. There were nine new trucks registered during this period.

Prices Advancing.

Improvement in business conditions in general and better prices for farm crops in particular are credited for the better outlook of the trade. During the past six weeks prices of wheat, corn, oats and hogs have shown a steady advance, and as Iowa is a leading corn and hog raising state this improvement is bound to put the farmer in a much better position. Corn has practically doubled in price within the last ninety days.

While the recovery of the farmer and his return to the market is to be a slow process, there are evidences that he has already started back. An inquiry conducted by one automobile dealer among 689 farmers in his territory elicited the information that of that number 87 made a definite statement that they would buy a new car this spring. Last year a similar inquiry was conducted by this dealer, and of 712 farmers interviewed only 13 made such a definite statement.

The condition in the truck business would also seem to show some improvement, particularly in the eastern cities of Iowa. This condition is, however, confined almost entirely to city business.

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Market Analysis Essential to Used Car Sales

Knowledge of markets essential in solution of used car problem. New car market and used car market must be considered as a unit. Service of used car has important effect upon reputation of manufacturer. Dealer quotas must be established fairly.

By Harry Tipper

THE market for the automobile is affected by the entire consideration from the time the automobile is produced to the time when it reaches the junk pile. The size of the total car population in any locality is directly affected by the service rendered by the automobile and the valuation placed upon it at different stages in its usefulness.

So long as the possession of a car was the most important reason for the distribution of automobiles there was no great tendency to consider intimately the cost of its operation nor the depreciation in its value. As the car population has grown, however, until the car has become familiar and most of the new car buyers have previously owned vehicles of this kind, the cost of operation and the depreciation in value become more important. For the great majority of the people in this country the original investment in the price of a car is not so important as the amount of money which must be paid out each month in order to keep the car running. This relates not merely to the new car but also to the second-hand car and its operation.

The total volume for new cars is related to the life of the vehicle, and also to the second-hand valuations. It is obvious that the market for new cars of any particular manufacture is affected by the life of that

particular car and the service it will perform in comparison with its valuation when it is transferred second-hand.

The manufacturer of automobiles, therefore, is intimately interested in the problem of valuing and disposing of used cars. The flow of new cars into the market must be regulated to agree with the flow of second-hand cars from buyer to buyer until they are junk. If there is any hesitation in the transfer of the vehicles at any point along the line, this will show itself in a lessened market for the new product, sooner or later, as a consequence.

It was stated in a previous article that the market conditions had not required a valuation on the part of the public as to the new car in relation to its service. Only lately has the buyer of a new car compared values with services for his particular purposes. The same thing has been true in the used car market. So long as the production was not sufficient to meet the demand, the used car sale was an individual matter between the buyer and the dealer. It represented no great comparative examination from the standpoint of service and it was not subject to the conditions of depreciation imposed by such valuation.

The general tendency must be for used cars from any given price group to come within a reasonable

comparative value—type, make and model considered. At present this is visible only as a tendency. The prices asked for used cars show an unstable market and a variation in valuation which does not aid the flow of the product, but which has a tendency rather to slow up the progress through which the automobile must complete its usefulness and reach the junk pile.

Every car that is being used by an individual owner, whether he has bought it new or second-hand, brings him into the business as a probable permanent customer for cars, or tends to drive him out of the business because of the difficulties imposed upon him by his first adventure. No matter what price may be paid for the used car, it is of no value unless it is in a condition to give service. No matter from whom it is bought, some of the difficulties that may be experienced reflect back upon the maker of the car and affect his market for the new product. It is obvious that the trade-in feature of the used car problem has affected the values and left the dealer in a position where he has paid more for such cars than it is possible to secure for them. It is obvious, in other words, that the trade-in has created a fictitious value in many cases for the used car and has slowed the progress of used car sales because of the loss entailed in moving them rapidly on to the market.

While this problem, of course, is a problem of the dealer, in the usual interpretation the manufacturer's market for new products is so intimately affected by the conditions operating in the used car field that it is necessary

for him to advise with and co-operate with his dealers in the endeavor to put this proposition upon a more stable foundation, so that the market value can be determined within reasonable limits and the conditioning done on a reasonable basis.

Similar problems have been met in other fields in their history of development, notably in the typewriter field, where exchange has persisted for a great many years. In the course of its development the typewriter field has progressed to the point where a typewriter has a valuation in proportion to its age and model, without much regard to its particular condition. It is likely that the tendency in the automotive field will be to establish valuations more in accordance with the year and type of a car, the make, etc., and less in accordance with the particular conditions of the individual car taken in.

It is unlikely that trading will decrease to any great extent in the near future, but it is probable that such trading will have to be done on a basis of more accurate general valuations which will permit of the proper conditioning so that the used cars will be serviceable when they are bought. So long as a car is being run with the maker's mark on it, to be recognized as the production of a certain factory, the service of that car is important to the manufacturer because it is affecting the opinion of some car buyer and reflecting upon his possible new sales. In the history of its progress any individual car passes out of the control of the manufacturer or his dealer, although its influence upon his future sales con-

tinues until it is junk. As a consequence the manufacturer is closely concerned with the ability of the dealer in the automotive field, the repair shop and the service station to value a used car properly, to sell it in such a way as to permit conditioning and to give a reasonable amount of service.

The present acute condition in the used car field is due mainly to the anxiety of the dealers to sell new product without considering sufficiently the character of the trade and its effect upon the total cost of the business. The fact that the used car would be affected by the same causes which affect the sale of new cars does not appear to have been thoroughly understood, and the further fact that backing up of used car sales must affect the new car market was largely overlooked. The present acute problem will be solved partly by the necessities of the dealer and partly by the effort of alert manufacturers, through co-operation, aiding the dealers to relieve themselves of this difficulty. It is likely to remain

a difficulty, however, for some time until the manufacturer and dealer thoroughly realize that the market for automobiles is inseparable and that the conditions affecting the market affect the whole market whether the product be used cars or new cars.

It will be a difficulty until the manufacturers and dealers realize that the used cars must be conditioned before being sold if they are to exercise proper influence upon the future sales of new cars of similar make, and it will be a difficulty until the character of the service and the extent of the service in repairs, rebuilding and adjustment are sufficient to take care of the requirements of the field in

this respect, so that the used cars may be bought upon a known basis of value and without the suspicion attaching to much of this business at the present time.

This part of the automobile market, although it has been discussed as a separate proposition, really affects the whole question of new car sales, the question of service, the repair shop equipment and car values. It should have a considerable place in the discussions leading up to the contract between the manufacturer and the dealer, and, in the course of time, it is likely that it should have some kind of a place in the contract itself where it relates to those cars affected by the contract conditions. The used car problem is a problem because of the following conditions:

1. The absence of established values so that no buyer is sure that he has received a proper value when he buys a used car.
2. Trades made without reference to the legitimate value of the car to be turned in and upon the individual condition of the car.
3. The sale of used cars without a proper amount of allowance for conditioning so that they would be in serviceable shape when they are bought.
4. The lack of proper facilities, sufficiently widespread in all parts of the country, for the general repairing and rebuilding of used cars so that the service can be extended to them whether they are in or out of production, until they no longer pay for repairs and are ready to be disposed of at the junk pile.

(Continued on page 550)

An Axle Designed Especially for Bus Applications

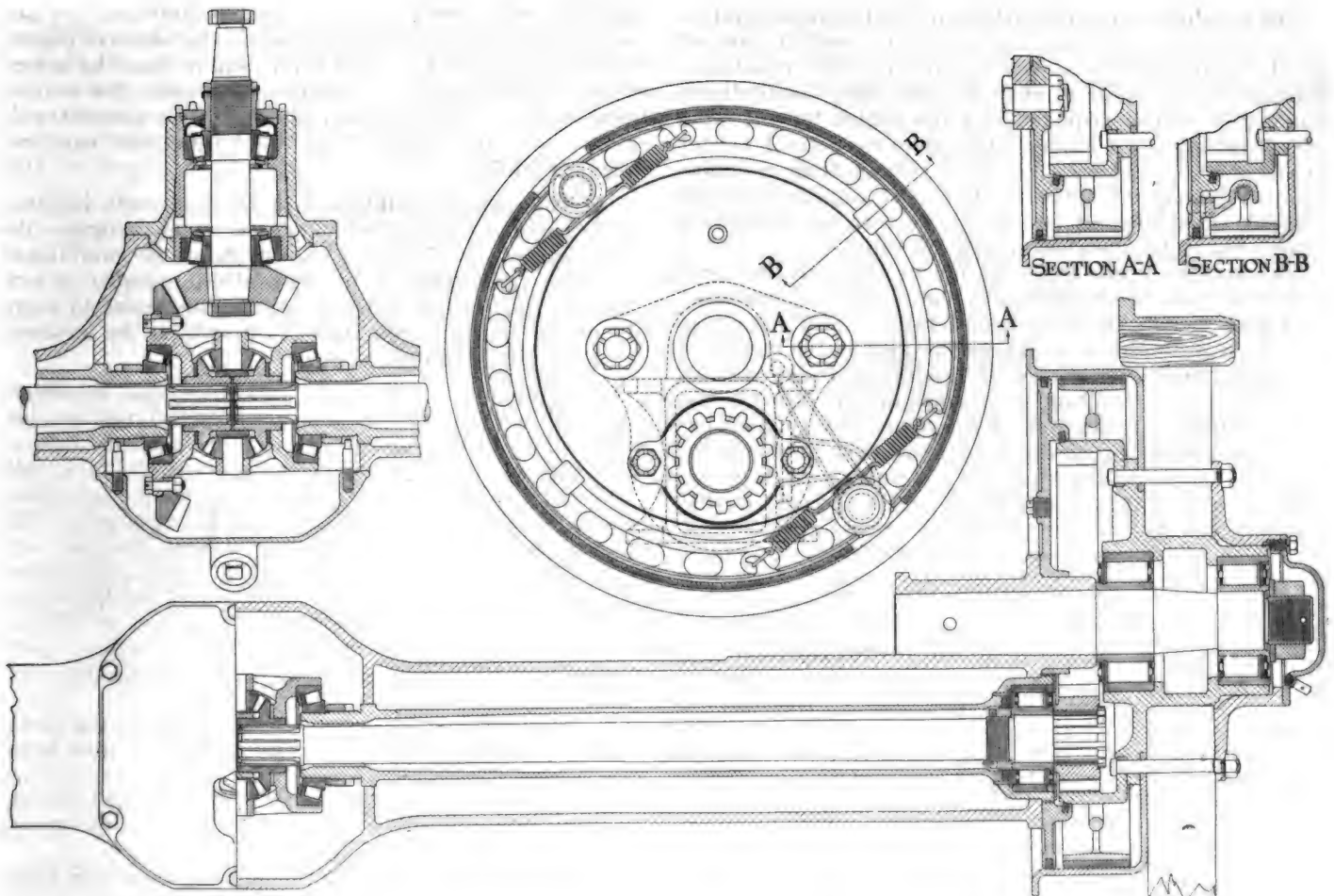
Is of internal gear type with differential and axle shaft below instead of in front of wheel spindle. It is thus possible to mount the chassis frame several inches lower than with conventional types. The design is quite simple, affords good accessibility and incorporates a number of refinements.

By Herbert Chase

TWO sizes of internal gear axles intended primarily for use on bus chassis have recently been designed by the Britton Axle Co. In general design the axles are similar to Britton truck axles, but in this case the live axle shaft is placed directly under instead of in front of the wheel spindle. By the use of this type of construction it is possible to make the frame of the chassis several inches lower than is otherwise possible, a considerable advantage so far as bus construction is concerned. The top of the differential case is slightly over 18 in. from the ground and the outside diameter of the case is only 10 $\frac{5}{8}$ in. when 34-in. tires are employed, while the spring seats, which do not require the use of separate chairs, are 1 $\frac{1}{8}$ in. lower than the axis of the wheel. The ground

clearance under differential is 7-7/16 in. In addition to these features the axles incorporate certain refinements in design which are readily seen by reference to the accompanying cut.

The differential is carried on the inner ends of a tubular member which surrounds the axle shaft and projects into the central differential chamber. These ends are threaded to receive collars which permit side adjustment and hold the differential against motion parallel to the axle. The collars are locked in turn by pins which project from the inner wall of the case cover into slots cut in the collar. The cover cannot be put in position without locking the collars. The tubular members are recessed to carry the pinion bearing at their outer end,



Sectional views of the new Britton bus axle

and are held in place by two bolts which when removed permit the tubes to be slipped axially outward after which the differential can be withdrawn.

The live axle or jackshaft is of high-grade alloy steel and is splined at each end. The arrangement is such that the pinion is very close to the bearing.

The brake anchorage plate is recessed on its outer circumference to receive a packing intended to prevent water and dirt from entering the brake drum, and carries a second packing set on an angle and arranged to retain oil within the polished tapered surface of the internal gear against which it bears. The latter is of $8\frac{1}{2}$ per cent nickel steel rolled or spun into shape from a flat integral piece. The teeth only are carbonized. On the model 30 axle there are 48 teeth of $\frac{4}{5}$ pitch, 20 deg. pressure angle and $1\frac{1}{2}$ -in. face. The gear is secured to the wheel hubs by twelve $\frac{1}{2}$ -in. alloy steel bolts which pass through the gear flange, hub flanges, brake drum and wheel. This construction permits replacement of the gear more easily than when the latter is riveted to the hub flange.

The pinion, which is also of carbonized alloy steel, is held in place by a threaded collar which is screwed onto the axle shaft and turns against an oil-retaining washer. The latter, together with the washer referred to above seal the gear chamber, which is said to remain tight when containing three pints of thin differential grease which lubricates the internal gear and the three bearings of the wheel and pinion. The taper roller bearings used on the

bevel pinion shaft are mounted in an adjusting cage which can be moved axially without disturbing the bearings, but the latter can be adjusted by turning the integral hex sleeve and nut mounted on the shaft after which these are positively locked in place by a tongued washer between the two. This construction avoids the use of two nuts and a plain spacing sleeve which, if the packing is made oil tight, is apt to hold the sleeve stationary and allow the nuts to wear and thereby destroy the bearing adjustment.

The bevel gears are of $8\frac{1}{2}$ per cent nickel steel, with 4-pitch carbonized teeth, 30 deg. lead angle and $1\frac{1}{4}$ -in. face. The ring gear has 37 teeth and the pinions from 13 to 22 teeth, giving total reductions, including that in the internal gear of 9.76 to 5.77 to 1. Spring centers on the model 30 axle are $42\frac{1}{2}$ to $45\frac{1}{4}$ in. The tread is 70 in. and the load capacity 8000 lb. One set of brakes is provided. These are of the internal expanding type and are easily removed by simply disconnecting the springs seen in the drawing.

The high-section modulus of the box-shape section of the axle is said to give it unusual rigidity with moderate weight. The makers claim that the axle contains a smaller number of both manufactured and standard (purchased) parts than any other similar axle on the market. With one exception right and left hand parts are the same, and the axle is so designed that it can be produced with the same tool equipment used on Britton truck axles.

Market Analysis Essential to Used Car Sales

(Continued from page 548)

The car dealers in any particular locality must analyze the market for cars for the particular period covered by the contract so that the market analysis takes into account the probable number of new cars, the probable number of trades required and the outlet for the used cars involved in the trades. This requires a much keener analytical consideration of the territory than we have been accustomed to give to it, and it requires a more careful consideration of the movement in individual ownership to be observed in that locality.

The dealer cannot maintain his business in new cars unless he can see a clear way to dispose of the used cars involved in the first transactions. New cars may be forced upon the local market by aggressive means of selling, to some extent; but this additional sale will involve a larger percentage of trades and will result in the dealer's failure to dispose of his used cars at a proper rate. In proportion to the number of cars in a community or a territory, the tendency of the increase in registrations and the condition of the cars owned in that locality would indicate the probable market for new cars. As the increase in registrations becomes smaller in its percentage against the total registrations, the virgin market for new cars becomes correspondingly smaller and a larger proportion of the market must come from those who own cars at present. Both new and used cars will be sold increasingly to people who have owned cars previously, and the total car market in the locality is confined:

First—To those who come in as new buyers of cars.

Second—Those who replace worn out cars.

Third—Those who desire to change an older type of car for the improved current type.

In general, in the country this year a great many of the car buyers will be in the second and third classes, and in each case of this kind the used car must be dis-

posed of, either by trade or by individual sale. In any case there must be an adjustment of the new car buying to the disposal of the used cars. There must be a reasonable adjustment of valuations between the two or there will be a backing up, either in the used cars or in the new cars, with a final effect upon the manufacturer's market.

The quotas established in the contracts between the manufacturer and the dealer must recognize the conditions in the locality, and should be established upon a fair analysis of the probable number of new cars required in order to permit the dealer to carry on his business effectually and to keep the business properly balanced.

From the manufacturer's standpoint, this establishment of a fair quota basis is of great importance because every new car sold without the corresponding flow of the used cars toward their destination as junk will obviate a future sale of the new cars until the choked condition of the used cars on hand is removed. This means, of course, a reasonable valuation, upon a more stable basis, of the used car so that it will not involve greater service value than the new product nor materially less service value in proportion. It is a more difficult matter for the dealer to finance himself on used cars, and they must flow in and out regularly if he is to maintain a sound business condition.

To the manufacturer a stock of used cars in the hands of various dealers is a menace to his future new sales. This is bound to happen unless the quotas are established on a careful and reasonable analysis and not merely upon the ability of the manufacturer to force the dealer into accepting the conditions.

In this problem, as in the question of new car sales, the thorough analysis of the territory looms up in importance.

Weidely Producing a New Engine

Is six-cylinder overhead valve type, intended for light and medium weight cars and is built in two sizes having respectively $3\frac{1}{4}$ and $3\frac{3}{8}$ in. bore. Force-feed lubrication is used throughout and the crankcase and cylinders are cast in block. Is said to develop 1 h.p. per 3.95 cu. in. displacement.

By J. Edward Schipper

A NEW six-cylinder engine for light and medium-weight passenger cars has been brought out by the Weidely Motors Co. It is to be marketed under the name of Forty Point Bulldog and will be immediately put in production.

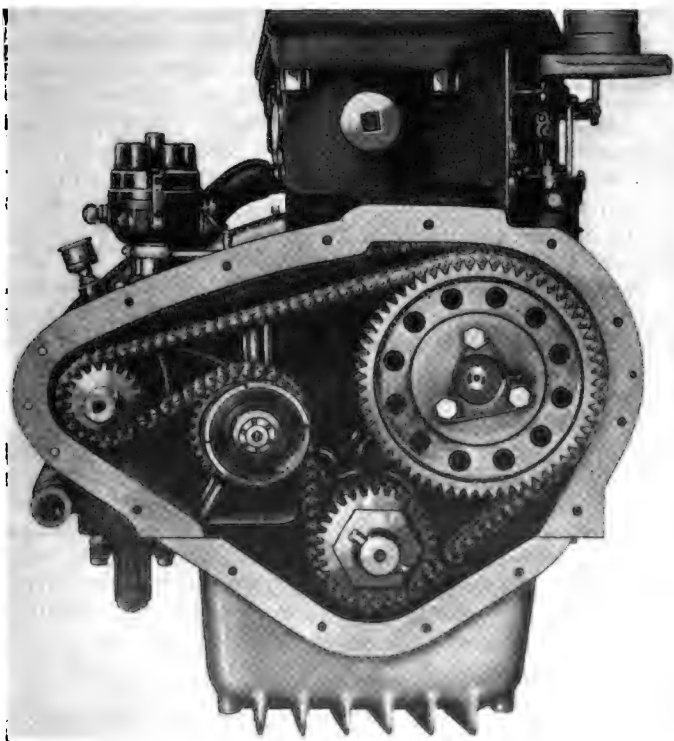
The new unit is an overhead-valve type, $3\frac{1}{4} \times 5$ in., developing 63 hp. at 3000 r.p.m. With a displacement of 248.9 cu. in., this is 1 hp. per 3.95 cu. in. displacement. The unit is also provided in $3\frac{3}{8} \times 5$ -in. size and is furnished with a No. 3 bell-housing for a unit power plant. The six cylinders, together with the crankcase, are a single casting, a detachable head and an aluminum underpan completing the engine structure.

It is claimed that high torque is developed throughout the entire range of speed. The compression is 77 lb. absolute at 200 r.p.m. with wide-open throttle. Considerable attention has been given to balancing of the engine; to reduce vibration to a minimum a large diameter crankshaft is used, and reciprocating parts are kept light and equalized. The pistons, including the wrist pin and three rings, weigh 1 lb. 8.7 oz. each. With the connecting rod the assembly weighs 4 lb. 3.7 oz., and the piston alone, without wrist pins, 1 lb. 2.3 oz. The clearance of the cast-iron piston ranges from 0.002 in. to 0.003. The

pistons are dome topped and are $3\frac{3}{8}$ in. in length. The piston pin is fastened in the piston, the bearing being in the upper end of the rod. S. A. E. steel No. 1020 is used for the piston pin, which is hardened and ground. The pins are 1 in. in diameter and weigh 3.10 oz. The piston castings are made with finish allowance for grinding only, and it is claimed that this results in a much harder and closer grained unit than is secured when more material is left for removal in machining. The piston rings are a deep, narrow type.

The crankshaft has three bearings and is forged of No. 1045 S. A. E. steel; it is $2\frac{3}{8}$ in. in diameter and weighs 79 lb. The main bearings are of the bronze-back, babbitt-lined type. The front bearing is $2\frac{3}{8}$ in. in diameter by $2\frac{1}{4}$ in. in length, while the other two bearings are $2\frac{3}{8}$ by 3 in. End thrust is taken up on the front bearing. The connecting rods are I-section drop forgings, of 11 in. center-to-center length, and weigh 4 lb. 3.7 oz.

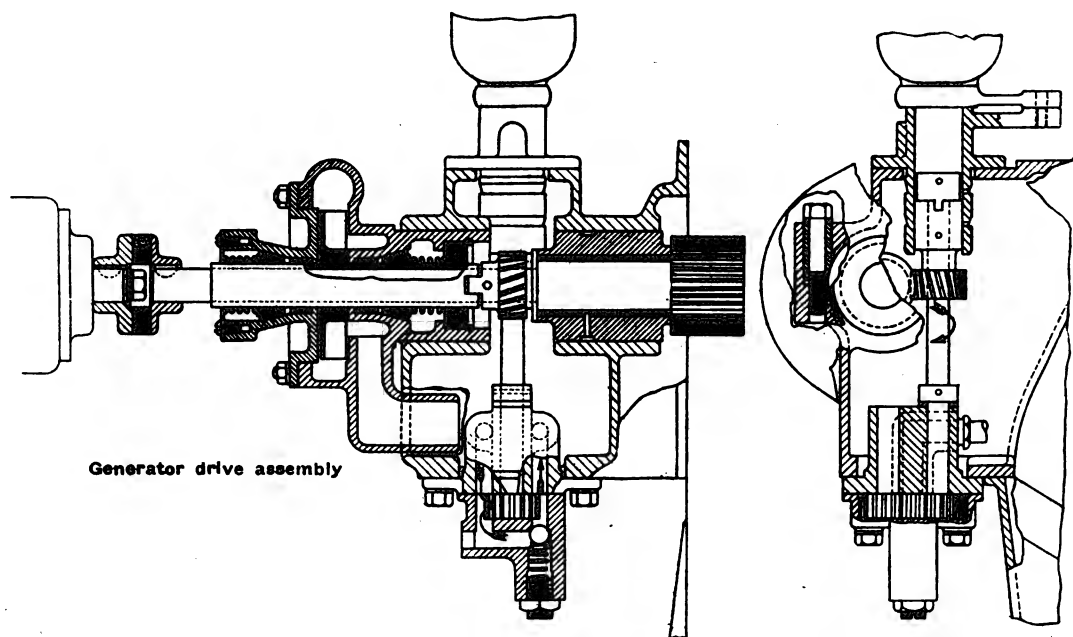
The timing drive is by chain. This is a Link-Belt unit having an automatic adjuster which takes care of the chain stretch. The take-up is on the flat side of the chain, as shown in the illustration herewith. The camshaft is drop forged from S. A. E. No. 1020 steel and is



Front view of engine showing automatic take-up acting on reverse side of timing chain



Three-quarter front view of new Weidely six-cylinder engine, designed for passenger car application



Generator drive assembly

13/16 in. in diameter. It is mounted in three bronze bearings of the following dimensions (front to rear): $2\frac{3}{8} \times 2\frac{1}{8}$ in., $1\frac{3}{4} \times 1\frac{3}{4}$ in. and $1\frac{5}{8} \times 1\frac{3}{8}$ in.

To secure a quiet valve mechanism, the rocker arm, push rod and tappet are held light in weight. The normal clearance between the rocker arm tips and the valve stems, when the valve is seated, is 0.004 in. The cam is so laid out that for 30 deg. before the point of valve opening the clearance is very gradually taken up, until the tip of the rocker arm is just in contact with the valve stem at the point where the valve begins to open. From this point on the valve opening is rapid. The closing incline of the cam is the reverse of the opening incline.

The intake valves are of chrome-nickel steel and the exhaust valves of Silchrome steel. They have a $1\frac{1}{8}$ -in. clear diameter, 5/32-in. head thickness, 5/16-in. stem diameter and 11/32-in. lift.

Lubrication is by pressure. The oil pump is a self-priming, gear type mounted on the side of the crankcase where it can be removed without disturbing any other units. It is arranged to pump into the oil line only such oil as is required at a set pressure. The pressure relief valve is located in the pump and so arranged that all excess oil is by-passed within the pump to the suction side, so that only so much oil is taken from the sump as is required for circulation through the distributing line at any time. An advantage claimed for this plan is that the breakdown of the oil, due to emulsification, is very much reduced. It is claimed that when oil is whipped around at high velocity and forced through small openings under high pressure it is broken up and quickly loses its lubricating qualities.

The oil is forced through a distributing tube to the three main bearings. The crankshaft is drilled so that the oil can pass freely from one end to the other, and the connecting rod bearings are supplied with oil from the inside of the shaft. This eliminates the possibility of the system being made inoperative by the accidental plugging of one of the lines, or even of two, as any one of the three will feed all the bearings on the shaft. From the front main bearings oil is forced to the accessory shaft bearings and to the drilled shaft forming the bearing for the automatic chain adjuster, from which latter shaft the oil finds its way to the chain proper.

By means of another line and holes drilled through webs in the upper part of the crankcase, oil is fed intermittently under pressure to the camshaft bearing and

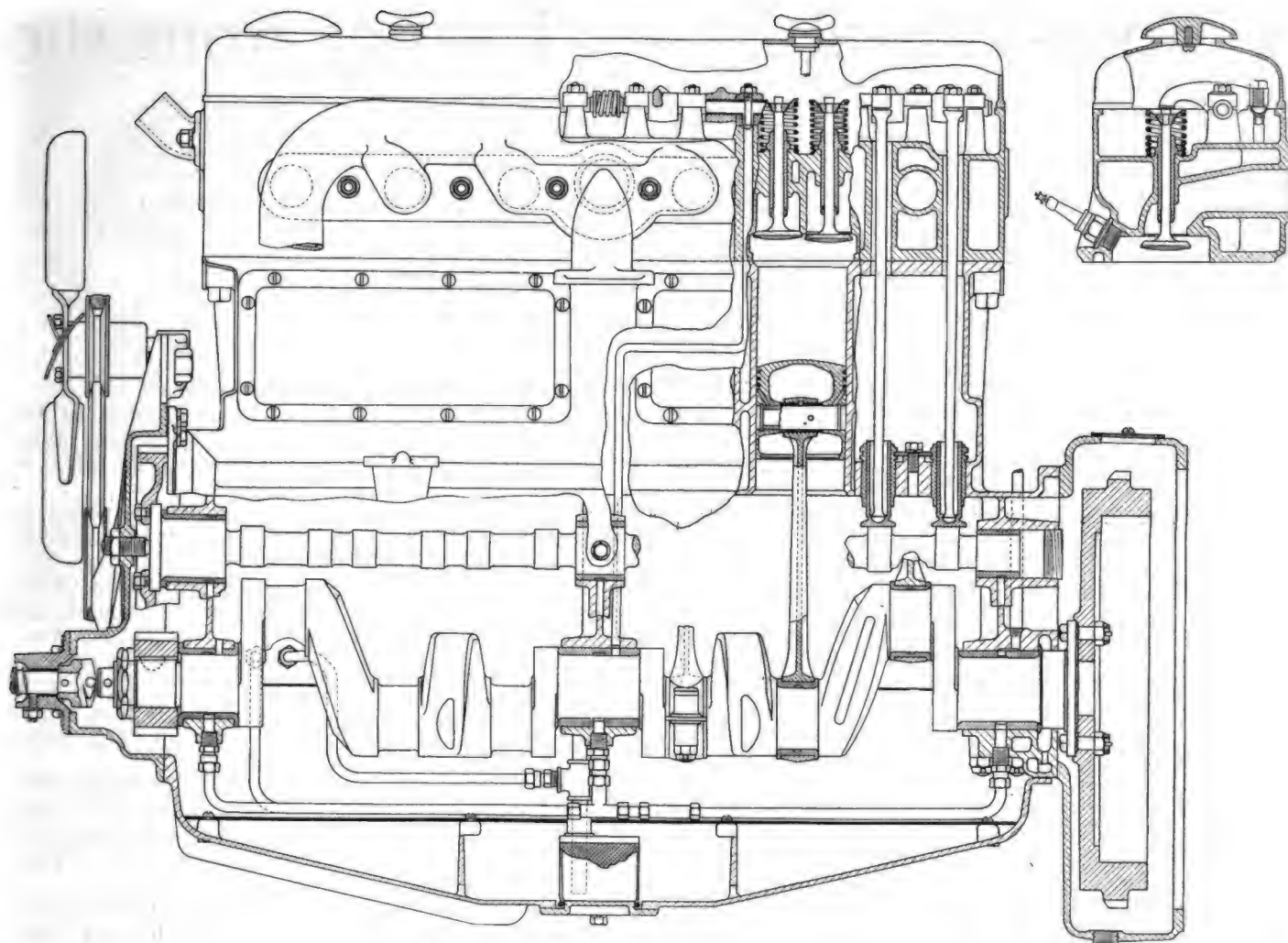
to the inside of the follow rocker arm shaft, from which it is forced to the rocker arm bearings and, through a hole in the rocker arm, to the top of the push rod, which is cupped to hold this oil. It then travels down the push rod to the valve tappet, lubricating the ball on the bottom of the push rod. The valve tappet is hollow and is cross-drilled to allow the overflow oil to escape, lubricating the valve tappet guide as it returns to the crankcase. The piston and cylinder walls are lubricated by oil thrown off by the connecting rods. On the down stroke of the piston the top edge of the oil relief groove scrapes the excess oil from the cylinder walls into the relief, from which it is carried to the piston pin. With this system, it is claimed, the entire overhead-valve action is working on a cushion of oil.

The major part of the inlet manifold is cast inside the cylinder head and is water-jacketed. That portion which is outside the head is integral with the exhaust manifold and thus acts as a vaporizer for the heavy fuel; it is entirely surrounded by the exhaust jacket, and any liquid fuel which may be creeping along the walls of the intake manifold stands a good chance of being vaporized there. The wall in the heated portion of the intake manifold is pocketed, so the liquid gasoline will be held until it is vaporized. The converter, as the exhaust-heated portion of the intake manifold is called, is comparatively short, so that the gas is carried through it quickly and the heat cannot penetrate the whole air stream in the short time of its passage. After leaving the converter, the gas passes directly through the middle of the head to the opposite side, where upon changing direction any unvaporized particles of fuel are again attacked by coming in contact with the unjacketed exhaust ports of cylinders Nos. 3 and 4.

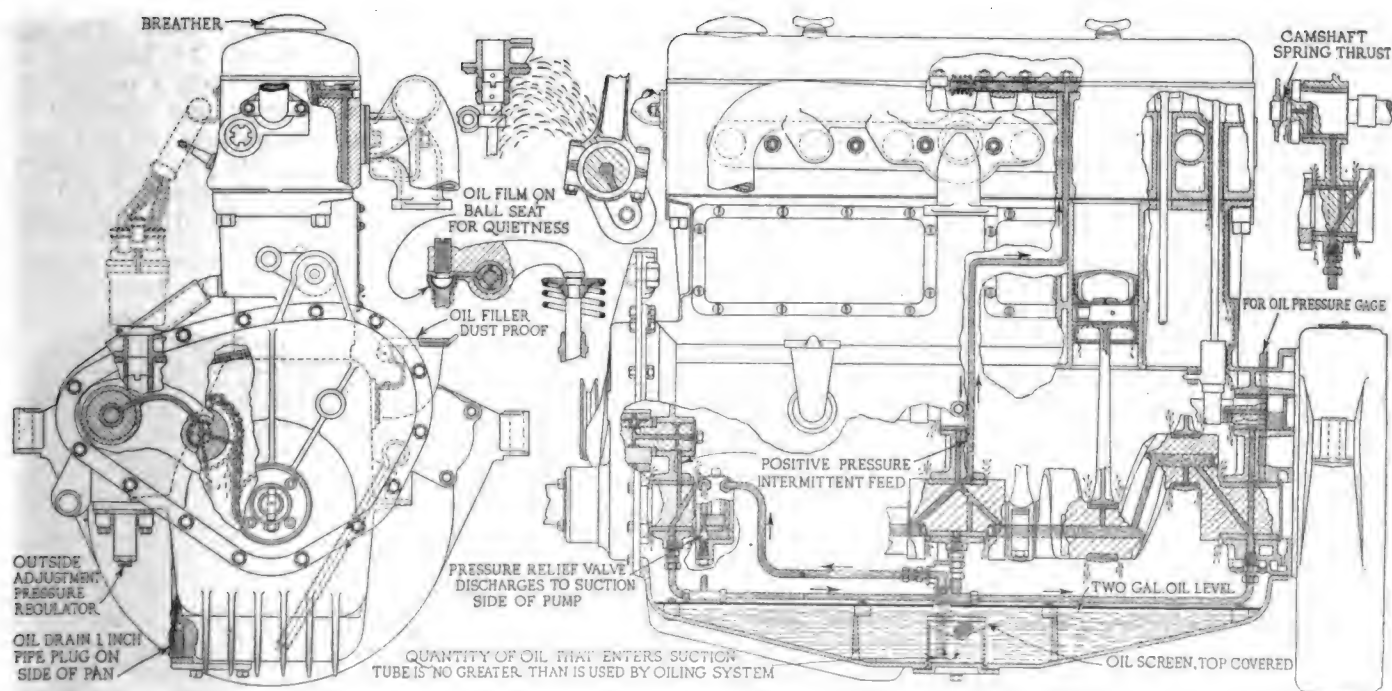
Water circulation is by a centrifugal pump. The entire pump assembly is a unit which can be taken from the engine by sliding it off the rear end of the accessory shaft. On each side of the impeller is a babbitt bushing to keep the shaft central, and beyond this bushing on each end is placed the packing. There is a $\frac{3}{8}$ -in. water space between adjacent cylinder barrels. The spark plug bosses are entirely surrounded by water, which is claimed to be unusual in overhead-valve engines.

An interesting feature affecting ease of repairs is that if the oil pan is taken off, the piston and connecting rod assemblies can be removed from the bottom of the engine. The oil pressure relief valve can be adjusted from outside the engine. The oil drain plug is located on the side of the oil pan where it can be conveniently reached.

The engine is arranged for a two-unit electrical system with S. A. E. standard mountings. For foreign orders a magneto can be mounted back of the generator, taking its drive from a double-ended generator shaft. A barrel mounting is provided for the starter, which is ordinarily located on the right side, but for right-hand-drive cars for the foreign trade it is just as convenient to locate it on the left side, as provision has been made for both locations. The weight of the engine without accessories is 575 lb.



Assembly view, in part section, of new Weldely engine



Oiling diagram, showing lubrication of crankshaft, overhead valve system and other units

A Four-Wheel Drive Tractor from the Pacific Coast

Wizard 4-Pull tractor transmits power to all four wheels by roller chains and steers by disconnecting power from wheels on one side. Engine of company's own design and manufacture. All transmission members enclosed in oil-proof cases. Tractor of unit construction without frame.

AMPLE traction being an important requirement in tractor work, it is not to be wondered at that a number of tractor designers have turned to the four-wheel drive. As compared with the conventional design, driven through the rear wheels only, it has the advantages that the maximum traction is increased and that all danger of the tractor being overturned by the torque reaction is eliminated. The usual four-wheel drive construction with live front and rear axles is rather expensive to manufacture, and as low cost of production is essential in the tractor industry, designers have been endeavoring to evolve new types of four-wheel drive which should be simpler and cheaper to build than the conventional form.

An interesting four-wheel drive tractor, known as the Wizard 4-Pull, has been placed on the market by the Kroyer Motors Co. In addition to the advantages of the four-wheel drive stated above, the ability of turning in a very short radius is claimed for this tractor, as not only does it drive by all four wheels, but it also makes use of the driving members for steering in much the same manner as a creeper tractor.

The four cast steel wheels run on 5-in. roller bearings mounted on stationary axles. The final drive is by roller chains direct from the transmission to the front wheels. The rear wheels are driven by separate roller chains from the front wheels. The two wheels on one side operate as a unit, independent of the wheels on the other side, and are driven through multiple-disk clutches controlled directly by the steering wheel. The method of mounting the wheels on the axles and the direct application of the power to the front wheels through the chain drive are clearly shown in one of the accompanying illustrations. The drive chains, operating at low speed,

are inclosed in a dust-proof case and run in oil.

Grease cups and oil holes have been eliminated and lubrication is entirely automatic. Two oil filler plugs are provided, one on the transmission and the other on the engine crankcase.

The engine is equipped with a gear-driven, gear-type oil pump that forces oil under pressure to the crankshaft, camshaft, connecting rod and piston pin bearings. Surplus oil from the bearings is showered over the timing gears and fan bearings, while the cylinders, pistons and valve mechanism are lubricated by the oil thrown from the connecting rods. The master clutch, the two steering clutches and the transmission gears and bearings work in a bath of heavy oil. An oil level gage is provided to show the oil level in the reservoir and an oil pressure gage is placed in plain sight of the operator.

The engine was specially designed by the Kroyer Motors Co. for heavy-duty tractor work and is of the L-head type. It has four cylinders, cast in pairs, with removable heads. The bore is $5\frac{1}{4}$ in., the stroke $6\frac{1}{2}$ in. and the engine runs at a normal speed of 850 r.p.m.

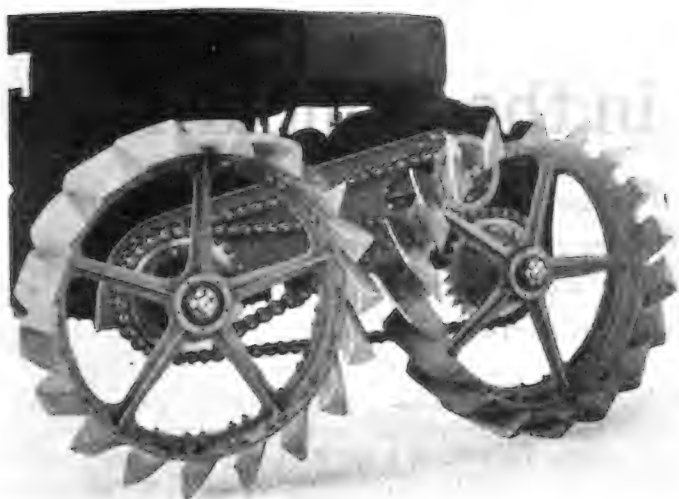
The crankshaft, which is $2\frac{3}{4}$ in. in diameter on the bearings, is drop-forged from open-hearth steel, heat-treated, and is supported by three main bearings, 4, 4 and 5 in. in length. The connecting rod bearings are $3\frac{1}{4}$ in. long each. The connecting rods are of I-beam section and are drop-forged from open-hearth steel. The cap is secured by four nickel steel bolts. All bearings on the crankshaft are hand-spotted to obtain a perfect fit. After the bearings are hand-spotted and fastened to their supports, the crankshaft, connecting rod and camshaft bearings are reamed to accurate size and centers. The working parts of the engine are assembled and the bearings are then run in cold on a power-driven running-



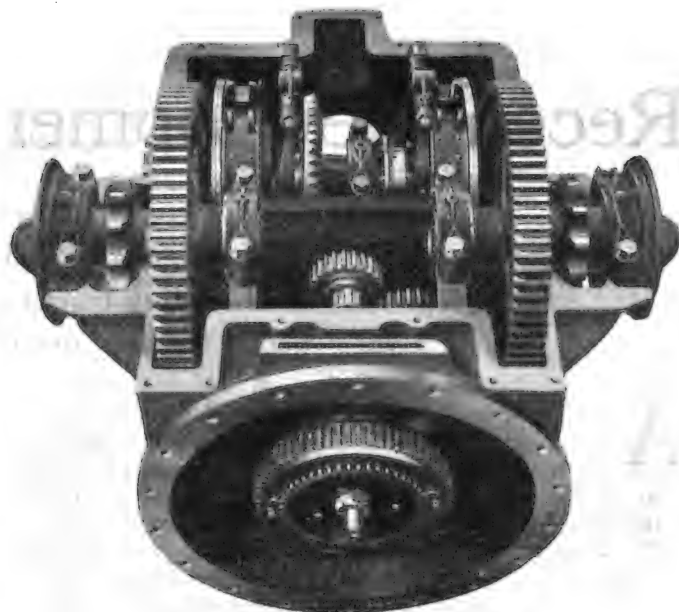
Wizard 4-Pull tractor



Side view of tractor with wheels removed, showing axle ends, chain sprocket pinion and engine details



(Above)—Chain drive to front and rear wheels
(Right)—Clutch and transmission with cover removed



in stand. All bearings are grooved, but not cut for oil clearance. The 0.002-in. allowance in reaming and the method of cutting the grooves is claimed to insure a film of oil on the bearing surface.

The camshaft is drop-forged and is supported by three bearings of different diameters, which allows the shaft to be removed from the front end of the engines.

The water space around the cylinders is said to be much larger than in the usual practice, and special provision is made for the circulation of water around the valves and spark plugs. The radiator is of the tubular type and water is circulated by a pump. The fan is gear driven.

The engine is equipped with a Bosch high-tension magneto with automatic impulse starting coupling. Provision has been made for dust-proofing the impulse starting coupling. The magneto is dust- and water-proof. The spark control and throttle are operated by one lever which is located within easy reach of the driver.

The engine is equipped with a flyball throttling governor acting on a butterfly valve in the inlet manifold. The governor is fully inclosed, yet it is readily accessible and can be quickly adjusted. The normal operating speed is 850 r.p.m.

Cranking of this large engine is said to be easily accomplished by means of a four-to-one geared starter on the front end of the tractor, which is clearly shown in the accompanying illustration. This starter disconnects automatically as soon as the engine starts, eliminating danger of back-kicks.

The engine is regularly equipped to burn either gaso-

line or distillate, but special equipment is provided to burn kerosene. Sufficient fuel-carrying capacity is provided for a day's work.

The transmission is of the selective, sliding-gear type. Gears and sprockets are forged from chrome nickel steel and are machine cut and oil tempered. The shafts are of nickel steel and are supported on large ball and roller bearings. All work is done on a direct-drive speed at $2\frac{1}{2}$ m.p.h. A geared speed of 4 m.p.h. is provided for transportation and commercial work. The reverse speed is 2 m.p.h. Both the flywheel clutch and the steering clutches are of the multiple-disk type, being composed of bronze and steel plates.

The belt power drive is a unit in itself and is attached to the rear of the tractor. It can be readily removed or attached by removing a cover plate and putting the belt drive unit in its place. The drive is direct from the crankshaft, through the flywheel clutch and through a spline coupling. The belt pulley runs parallel with the tractor and turns at the same speed as the engine crankshaft. Roller bearings are used on the pulley shaft.

The tractor is of unit construction without frame. Its normal drawbar pull is 3000 lb. at a speed of $2\frac{1}{2}$ m.p.h. With standard leader shoes the machine is 66 in. in width, 110 in. in length and 67 in. in height. For vineyard use leader shoes are provided, giving a width of 58 in., while for peat or swamp land shoes of greater width are provided, giving a tractor a width of 72 in. For a machine of its drawbar capacity the Wizard is of very compact design and comparatively light, weighing only 6800 lb.

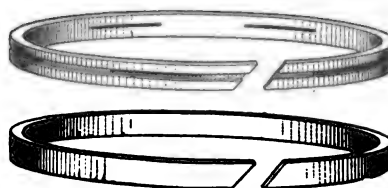
A New Design of Piston Ring

PISTON rings in sets of three, of which two are to hold the compression while the third is designed to distribute or regulate the oil, are being marketed by the Indiana Piston Ring Co. The compression rings are of the usual form with scarfed joint, the process of manufacture being such as to assure accuracy to within 0.010 in. when tested in a flexible gage and the shutting out of all light when tested in a round gage. These rings are also said to be entirely free from edge warp.

The oil-regulating ring is machined with a groove around its circumference midway between its edges. This groove acts as an oil reservoir. Any surplus oil

collects in the groove and is drained into the piston ring groove through slots through the ring which are

about equally spaced over its circumference. From the ring groove the oil can be drained back to the crankcase through holes drilled through the piston wall at the bottom of the ring groove in the usual way.



Rings manufactured by
the Indiana Piston Ring
Co.

Recent Development in the Railcar Field

Both cars here described are fitted with regular and special reverse gearsets which make possible high speed operation in either direction, and both employ four-wheel leading trucks with live axles running in plain bearings. Other special features described include cushion wheel.

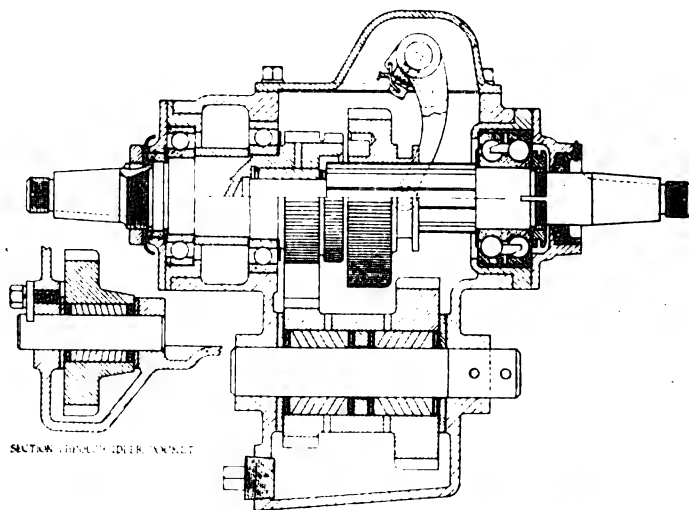
AMONG the truck manufacturers who are turning their attention to the construction of truck chassis especially equipped for use on rails is the Indiana Truck Corp., which has modified its 2½-ton chassis for this purpose. This chassis is equipped with a four-cylinder 4¾ x 5½ in. engine which drives through a dry plate clutch to a conventional four-speed gearset. Between the latter and the rear axle is mounted a special reverse gearset made by the Warner Gear Co. and shown in the accompanying cut. The main shaft of this gearset is divided and has a positive internal-external gear clutch arranged in similar fashion to that employed in the usual type. The rear portion of this shaft is splined and carries a sliding gear which in its forward position engages the positive clutch and drives directly through to the propeller shaft to the rear axle. When the gear is in its rear position, the drive is through the constant mesh gears, one of which is an idler, to the lay shaft and thence back to the sliding gear, which drives the tail shaft in a reverse direction. This arrangement is similar to the drive through reverse gears in conventional transmissions, but the pinion in this case is carried on a Hyatt bearing and runs on a stationary shaft supported at both ends.

The use of this auxiliary transmission enables the railcar to operate at full speed in either direction. The propeller shafts between the two gearsets and between the reverse gearset and the axle are tubular and are fitted with metal universal joints.

The rear axle is a Sheldon worm drive semi-floating type and is fitted with two sets of internal brakes operating on wheel drums, one set being hand-controlled and the other operated by pedal. Rear wheels are artillery type wood with fourteen 2 in. spokes and cushion rims fitted with flanged rolled steel tires of 37 in. diameter.

The front axle is replaced by a four-wheel leading truck built up of structural shapes hot-riveted together. The

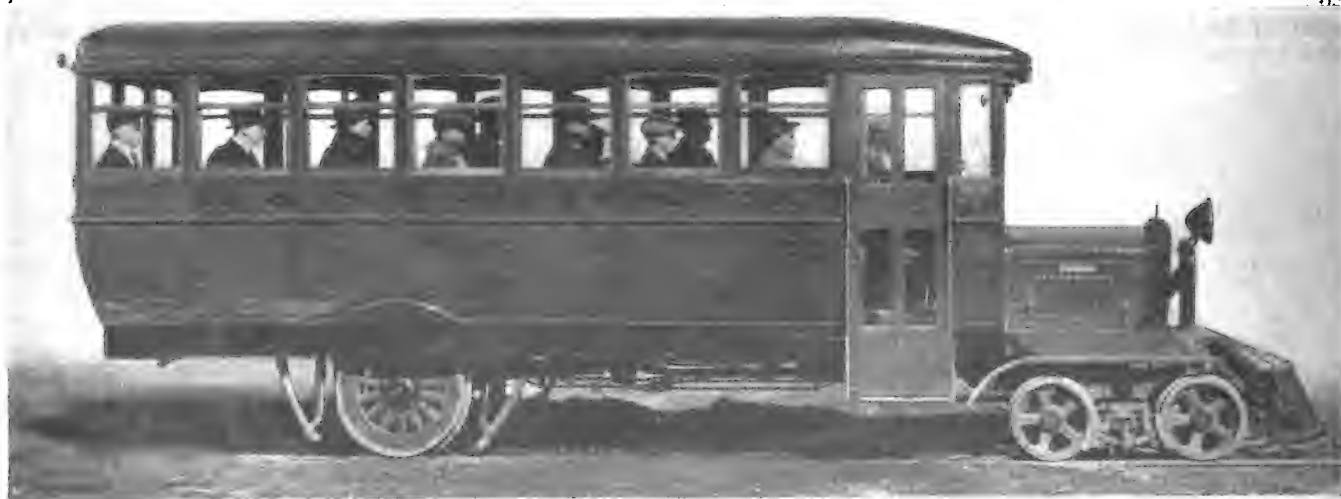
bolsters are fitted with top and bottom plates through which pass the kingpin and are provided with swing links. The wheels are of cast iron, 20-in. diameter, with chilled face and flange. They are forced on the live axles which run in bearings in cast steel journal boxes. Cast iron



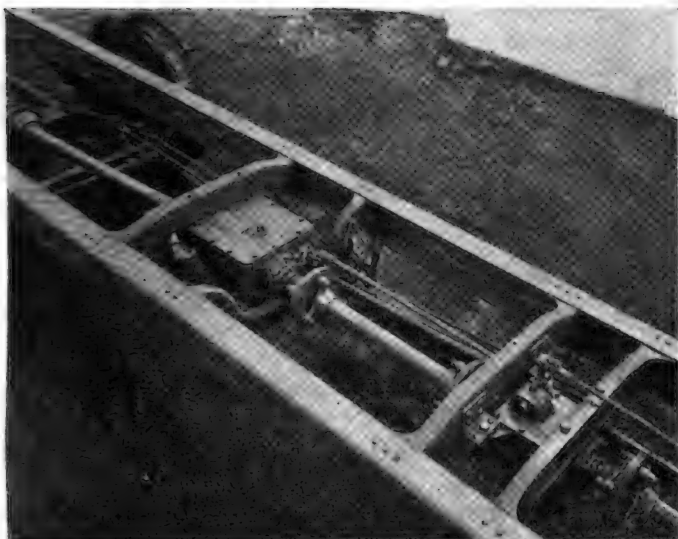
Warner high speed reverse gearset for use on railcars

brake shoes are arranged to bear on each front wheel and are applied by turning the steering wheel. The chassis frame is made of 6-in. structural channel weighing 8 lb. per ft., is hot riveted and reinforced by gusset plates. The wheelbase is 180 in. Front springs are 40 in. long by 2½ in. wide and have nine leaves. Rear springs are 50 x 3 in. and have eleven leaves.

The body is of oak and is arranged to carry thirty passengers. The equipment includes electric starting



Side view of Indiana railcar



Rear half of Service chassis showing mounting of high speed reverse and regular gearsets

motor and lighting generator, sanders in front and behind each rear wheel, steel pilot and fenders over front truck.

The Service Railcar

Another concern which has done considerable work in the development of trucks suitable for use on rails is the Service Motor Truck Co. This company has had in operation for several years a railcar based upon its standard 2½-ton, long-wheelbase model and will soon place in service a larger railcar of special design. The 2½-ton railcar is provided with a body seating 32 passengers and is capable of speeds of 25 to 30 miles an hour, depending upon the gear ratio employed. This, in turn, depends upon the grades which are to be negotiated. The car is fitted with 4¼ x 5½-in., 4-cylinder engine which drives through a single flat clutch to the Warner high-speed reverse gear, a section of which is shown herewith, and the reverse gear ordinarily used in the standard gearset is omitted.

The special reverse gear is located between the engine and the standard gearset and is mounted between two frame cross-members in the manner shown in the accompanying cut.

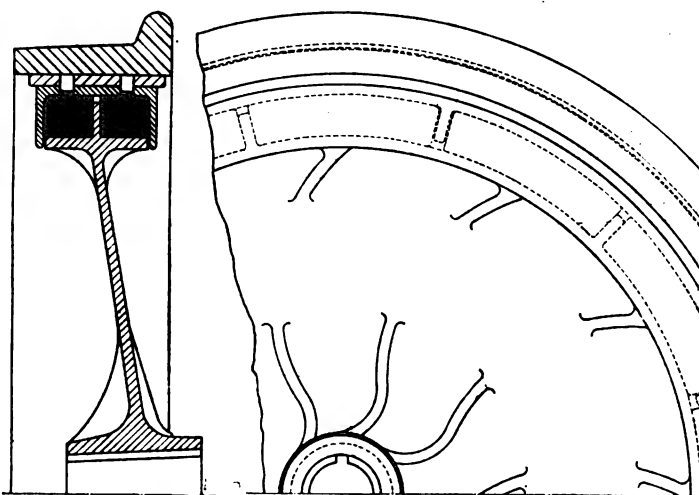
The front axle is replaced by a standard four-wheel loading truck, manufactured by the J. G. Brill Co. This is provided with solid axles with pressed-on wheels of

chilled iron. The axles are carried in plain brass bearings of the railway type, running in oil. The framework of the leading truck is a combination of structural and cast steel, to which are bolted the front springs of the regular chassis. A full-swing motion bolster, which facilitates steady riding on curves, is incorporated.

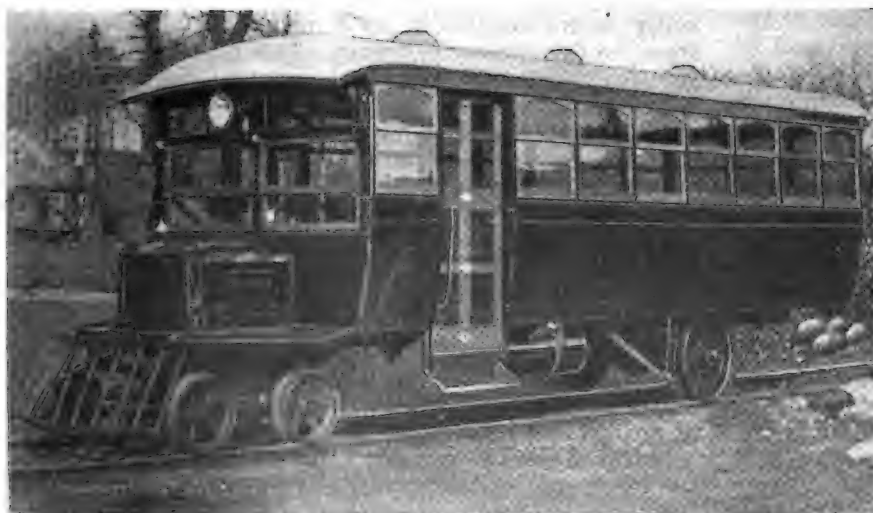
Cushion Driving Wheels

Another feature which departs from standard practice, so far as truck chassis in general is concerned, is the use of a special cushion wheel, a section of which is shown in one of the accompanying cuts. It will be noted that this wheel has incorporated between the rim and the central portion a series of rubber blocks which tend to prevent the transmission of shocks, such as those caused by passing over rail joints, to the chassis and body. The design of this wheel is such as to prevent transverse motion which can occur in some other types of cushion wheels and result in unpleasant oscillation of the rear end of the chassis frame. In this case stresses which would tend to produce such motion are taken up by contact between the side member of the box-like section containing the rubber blocks and the ring to which the spokes or disk carrying the hub are attached. In the case of the smaller railcar, wooden spokes are substituted for the metal disk shown in the cut.

The rear axle is of the worm-drive type and is fitted with the special wheels described, the latter being sup-



Sectional view of cushion wheel used on Service railcar



Service railcar fitted with entrance doors at each side

plied with M. C. B. standard rolled steel tires of 32 in. outside diameter.

The Service railcar described is said to have traveled over 25,000 miles, during which the following data was secured: Normal speed, 30 m.p.h., will take 2 per cent grade on high gear and haul a trailer weighing about 6 tons, loaded, up a 4 per cent grade at 15 m.p.h. on third gear. Gasoline consumption is given as 10 miles per gallon and oil consumption at rate of 400 miles per gallon. The cost per day on a round trip of 84 miles, including crew, gasoline and oil and maintenance, is said to average less than \$10, while the earnings are given as over \$30.

Equipment includes electric starter and lighting generator, storage battery, fenders for front truck, steel pilot and hand-operated sanders front and rear of driving wheels.

Air Cleaner Applied to Truck Engines

Severe tests show effect of air cleaner on power output, fuel consumption and inlet manifold vacuum at different speeds. Five times more dust in air taken from under motor hood than from air drawn from inside driver's cab. Results and details of the experiments are given in this article.

THIS report on experimental work to show the effect of air cleaners on truck service in general, and the effect on the power and economy of engines in particular, was carried on by A. A. Bull, chief engineer of the Northway Motor & Mfg. Co. and should be of interest to truck manufacturers and operators.

Four distinct lines of research were embraced in the experimental work:

1. An air cleaner was installed on an engine in the company's dynamometer room, and the power output determined before and after installation.

2. Means for agitating dust were provided in the dynamometer room, the amount of dust provided being about the same as might be expected in normal operation, and power output, fuel consumption and increase in the inlet vacuum recorded.

3. An air cleaner was installed in the Northway Company's factory truck and records of performance obtained periodically.

4. Another air cleaner was sent to the General Motors Truck Co., for installation in a territory where dust was bothersome. In this case observations were recorded at intervals.

Following is a report of a road test with a 3½-ton G.M.C. truck with air cleaner installation. The air cleaner was mounted on the forward side of the dash, a hole being cut through the dash to provide for taking air from the driver's cab. A piece of 1¼-in. flexible tubing 20 in. long was used to connect the air cleaner to the carbureter. Air passed through a 60 mesh copper screen before entering the cleaner. The inner drum of the cleaner was covered with sheet felt, through which the air was drawn. The driver's compartment was open at the sides, but the wind-shield was closed.

The truck, with air cleaner, was driven 17.5 miles on a dirt road at speeds of from 8 to 18 m.p.h., averaging 10 m.p.h. A touring car was driven a few feet ahead of the truck, in such a manner as to stir up a heavy cloud of dust. The inner drum of the cleaner with felt was weighed before and after the road test, to determine the weight of dust collected by the felt, the results of the weighing being as follows:

Weight of drum, felt and sand after test.....1 lb. 5.97 oz.
Weight of drum, felt and sand before test.....1 lb. 5.81 oz.

Sand0.16 oz.

No sand passed through the felt.

Next a test was made in which the air for the engine was taken from under the hood. A new cleaner, exactly like the one used in the previous test, was installed in the same location but with the air intake facing forward, to take air from under the hood instead of from inside the driver's cab.

The test was then repeated under the same conditions except for source of air, and the weighing gave the following results:

Weight of inner drum, felt and sand after test...1 lb. 5.81 oz.
Weight of inner drum, felt and sand before test...1 lb. 5.01 oz.

Weight of sand collected on felt.....0.80 oz.

This was five times the amount of sand collected when air was taken from the driver's cab. After each test, a heavy coating of sand was observed on the truck and engine, testifying to the severity of the tests. Inside of the inner drum there were no indications of any sand having passed through the felt.

The following table shows the effect on the power output, fuel consumption and inlet manifold vacuum at different speeds, of the clean air cleaner and the same loaded with dust.

R.P.M.	B.H.P.			Fuel Consumption Pts. per Hp.-Hr.			Negative Pressure in Intake—In. of Hg.		
	Without Cleaner	Cleaner without Dust	Cleaner with Dust	Without Cleaner	Cleaner without Dust	Cleaner with Dust	Without Cleaner	Cleaner without Dust	Cleaner with Dust
400....	8.7	8.5	6.6	0.920	0.942	0.970	0.1	0.1	0.15
600....	14.2	13.9	13.9	0.900	0.959	0.981	0.3	0.3	0.1
800....	19.3	19.5	19.2	0.843	0.933	0.947	0.6	0.25	0.1
1,000....	24.6	24.2	23.5	0.842	0.827	0.812	0.77	+0.3	+0.3
1,200....	29.4	28.3	27.4	0.928	0.848	0.876	1.075	+0.3	+0.3
1,400....	32.2	31.5	29.8	0.848	0.828	0.876	1.7	0.0	+0.3
1,600....	34.7	33.4	32.0	0.824	0.856	0.938	2.1	0.0	1.5
1,800....	36.2	34.7	32.4	....	0.824	0.926	2.6	0.3	0.6
400....	4.0	4.0	4.0	1.210	....	....	9.3	4.65	2.75
1,000....	10.0	10.0	10.0	1.101	....	....	11.35	9.6	8.4
1,600....	16.0	16.0	16.0	1.071	....	....	11.75	10.0	8.4

Water temperature, 120°-150° F.

The dynamometer tests with reference to the effect of the cleaner on the power, fuel consumption and inlet manifold pressure were made primarily to determine the advantage of taking the air from the driver's compartment instead of from beneath the hood, in order to minimize the amount of dust drawn into the engine.

It was further decided to demonstrate whether an air cleaner of the felt filter type could operate satisfactorily under severe conditions, as a result of taking the air from the driver's compartment. This type of cleaner has been used with apparent success on the Government military trucks. It undoubtedly has a disadvantage—that it cannot handle great volumes of dust without affecting the operation of the engine.

The design of the cleaner used in these tests was similar to that employed on the class "B" military trucks, with the exception that it was mounted vertically and in such a manner that vibration of the truck would automatically clean the filter.

The usual method of testing this filter has been to introduce large volumes of dust in such a manner that ultimately the filter felt would be choked, creating a high depression in the intake manifold, resulting in loss of power and increased consumption.

It is obvious, however, that this method of testing does not represent service conditions, in that the amount of dust introduced in a short time is probably considerably in excess of that which would be obtained under ordinary

operating conditions, and it is probable that such a cleaner would fail in the test indicated and yet be satisfactory where the amount of dust handled was relatively small and it operated under such conditions that it would have a chance to clean itself. Therefore, the tests conducted were made with the idea of reproducing the very worst conditions that the truck might be expected to operate under in actual service.

From the results of the tests, it is clear that the amount of dust drawn in by the motor is five times greater when the air is taken from under the hood than when it is taken from inside the driver's compartment, and, there-

fore, it is preferable to take the air from the driver's compartment, whether a cleaner is installed or not, as in that case less dust will get into the engine.

Power and fuel consumption tests evidence a slight reduction in power output, together with an increase in fuel consumption when the cleaner is covered with dust. It is believed that the maximum amount of dust adhered to the filter felt, and though this test represents the worst condition that would exist under ordinary circumstances, if the carburetor were properly adjusted to provide for the added depression, there would be no increase in fuel consumption.

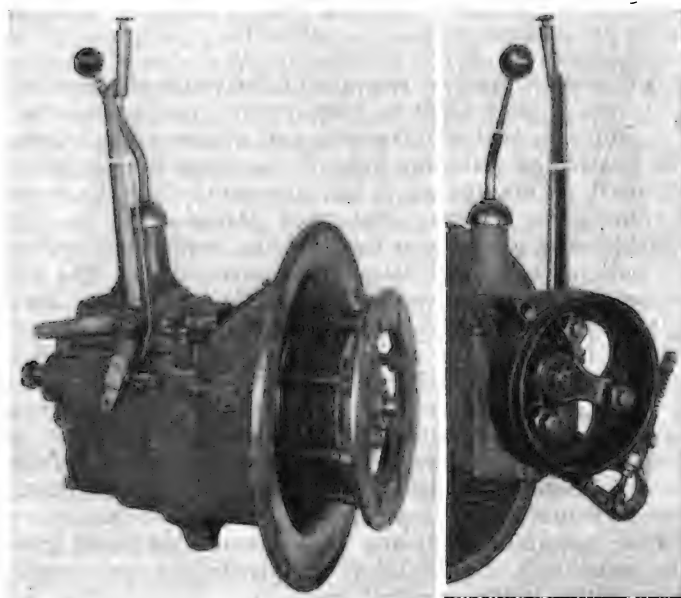
New Passenger Car Gearsets

TWO new passenger car gearsets for medium size cars and for larger cars have been brought out by Fuller & Sons Mfg. Co. Both have three speeds forward and one reverse. Short and heavy construction of the mainshaft and countershaft is intended to prevent springing apart when there is a heavy pressure on the gear teeth and to give durability, less vibration, and a quieter transmission. Provision is made on both models for attaching a tire pump if desired. A transmission brake bracket can also be attached to the rear of the transmission to accommodate Norwalk or similar transmission brakes.

When the oil level is brought to the top of the filler hole the oil level in the transmission is correct. The clutch throwout bearing is lubricated automatically by the gear-set oil.

The countershaft of the Model F for medium size cars has different construction than heretofore used in Fuller transmissions. The countershaft gears are cut in one piece from bar stock, $3\frac{1}{2}$ per cent nickel steel. These gears revolve on a stationary countershaft with Hyatt roller bearings. After hardening, the bore of the gears and the countershafts are ground true to assure true centers, quietness and long life. The mainshaft gears and mainshaft are also $3\frac{1}{2}$ per cent nickel steel, with shafts and gear bores ground.

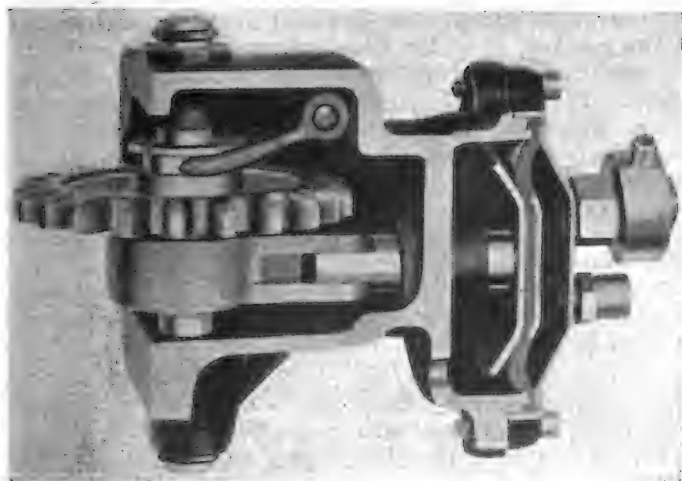
Model TU-5 transmission is for six-cylinder engines up to 400 cu. in. piston displacement. The clutches used with both models are the standard Fuller multiple disk construction which is standard equipment on a number of



Two views of new Fuller gearset showing also the Fuller multiple disk clutch and method of mounting transmission brake

makes. The drive is through hardened steel pins to hardened saw steel disks faced with asbestos fabric on both sides.

Motor-driven Tire Pumps



Sectional view of pump

A NEW, motor-driven tire pump suitable for transmission or other type of installation in which it is claimed that the air chamber requires no oil has been brought out by the Detroit Carrier & Manufacturing Co. The pump is a diaphragm type, in which the diaphragm is driven off the pump shaft by a crank and connecting rod arrangement. The pumping is effected by the reciprocation or pulsation of the diaphragm and, consequently, requires no lubrication. The pump is so manufactured that replacement of the diaphragm is a simple matter should it become necessary and consists of but very few moving parts. It is shown sectionally herewith.

THE Province of New Brunswick, during 1921, spent a total of \$400,000 on construction and improvements of roads. The total amount collected in automobile fees was but \$276,322. Much of the new construction was on the road connecting the North Shore with Montreal and Quebec.

Standardization Necessary to Tractor Industry Progress

Mr. Heldt points out in this article the fundamental necessity for standards in the tractor industry and suggests certain lines for immediate action. The number of belt speeds and screw sizes might well be reduced, while uniform lug fastening would be advantageous. An interesting analysis.

By P. M. Heldt*

PERHAPS the best example of the value of standardization that could be cited to the tractor manufacturer is that of magnetos and magneto mountings. The location of fastening holes in the base, the height of the shaft center, the shaft end dimensions and the overall dimensions of magnetos were standardized by the S.A.E. a good many years ago, and this standard is generally adhered to by the magneto manufacturers. The advantage to the tractor manufacturer lies in the fact that, with possibly a few exceptions, any magneto on the market will fit his engine without special adaptation. If his regular source of supply should fail for any reason, such as a fire, strike or flood, he could arrange with any other factory to supply him temporarily with its product. Provided the mounting arrangements were in accordance with the S.A.E. specifications he would have no difficulty whatever in mounting the new magneto. I believe that every tractor manufacturer using high tension magneto ignition makes use of this S.A.E. standard—and there could be no better indorsement of its value.

Now, how does this plan of standardization look to the magneto manufacturer? We can imagine him arguing: "If it is so easy for my customers to substitute another magneto for mine, it is certainly not to my advantage; my hold on my trade will be loosened, and it is not for me to encourage standardization."

There undoubtedly has been in the past in some industries a feeling of this kind with respect to standardization, which has been the cause of much of the opposition which the movement has had to contend with. It is easy, however, to prove that this attitude has a very weak foundation. The same standardization which makes it easy for the customer to change from your own to a competitor's product also makes it easy to change from your competitor's product to yours. Therefore, unless you already control the whole of the business and have no chance of getting any more, you have nothing to fear from standardization on this score. This point is borne out by the fact that all makers of high tension magnetos are using the S.A.E. standard.

Standardized Magneto Mounting

There is, however, also a very direct advantage in mounting standardization to the magneto manufacturer. It relieves him of the necessity of manufacturing his machines separately for each customer. There are still slight variations in the demand, in respect to direction of rotation, position of timing lever, etc., but these can be readily met. With the exception of a few parts, the machines are

all alike, which reduces manufacturing costs and permits of working for stock.

Another set of most important S.A.E. standards that are being used by the tractor industry are the steel standards. There is now a general tendency in tractor design to reduce weights, and this means the increased use of alloy steel in shafts, gears and similar parts. Now, the alloy steel industry has grown up with the automobile industry and is very much dependent upon it. There is no other industry that uses alloy steels to anything like the extent of the automobile industry, and the statement was recently made that 70 per cent of all the alloy steel produced in this country goes into automotive plants.

Value of S. A. E. Specifications

Alloy steels are made almost exclusively to S.A.E. steel specifications, and the parts manufactured from them are heat treated according to the S.A.E. specifications. The standardization of steel specifications and of heat treatments is among the most valuable work the Society has done. In connection with the tables of physical properties published some years ago, it enables the engineer to pick out the steel best suited to any particular purpose and to specify a heat treatment that best meets the requirements of the case. The work has not been limited to alloy steels but covers carbon steels as well, and most of the drop-forged crankshafts and connecting rods used in tractors are made of an S.A.E. specification steel. It is unnecessary to dwell upon this particular item of standardization, as the more extensive use of S.A.E. steel specifications by the tractor industry will come about naturally as the more primitive methods of construction typified by the use of structural steel and cast gears are abandoned.

The greatest need for standardization always exists at the points of connection between the products of different plants. The tractor connects by drawbar to the plow and other implement, and by belt to the separator or other power driven machine. Every tractor should be capable of connection to any plow or other implement, which necessitates standardization of the hitch; and every tractor should also be capable of driving by belt all the usual agricultural power machinery at proper speeds, which necessitates standardization of belt speeds. The height of drawbar hitch has been standardized and this standard is used by a good many manufacturers, but not by all. A moderate variation in the height of hitch is perhaps of no great moment, as the drawbar connections will take care of it. On some tractors, of course, the height of hitch is adjustable, but where this is not the case it would be an advantage to have the hitch a certain standard height.

*Paper read at the Minneapolis tractor meeting of the S. A. E.

Belt speeds also have been standardized, and, in fact, the original standard has been revised already. The belt speed was first fixed at 2600 ft. p. m., but it was found that a single speed did not meet all requirements. At the present time the S.A.E. has four standard belt speeds and the N.I.V.A. has even one more. It is possible that temporarily this number of different speeds is necessary because of the requirements of the various types of power driven machinery now on the market. The designers of these machines had nothing to guide them in determining the size of their pulleys, and the result is that there is absolute lack of agreement as to the required belt speeds. But in the future this condition could be remedied, and I believe that eventually there will be no need for more than two standard belt speeds. The situation here is somewhat similar to that in the pneumatic tire field, and I believe the problem could be solved in the same way as that tried there.

Pneumatic Tire Sizes

Some years ago, when a standard list of pneumatic tire sizes was first given out, it contained a certain number of sizes which were designated as definite standard sizes, and a number of others which, it was explained, were to be continued by the manufacturers only while the replacement demand for them continued. This served as a sort of warning to car designers that new cars should be equipped only with the definite standard sizes.

In the determination of standard belt speeds there should be co-operation between the manufacturers of tractors and stationary farm engines on the one hand—because the same agricultural machinery that is driven by tractors is also driven by stationary engines—and the manufacturers of this machinery on the other. If, say, two definite standard belt speeds were agreed upon, then the designers of agricultural machinery in future would equip all new types of machines with pulleys calculated for one or the other of these speeds, and the situation would gradually become simplified.

One class of standards relates to materials of construction or basic machine elements. Of the standards of this class that were adopted originally for the automobile industry many are now in use in the tractor industry. I need only mention the S.A.E. standard steels, non-ferrous alloys, tubes, screws, washers, pipe fittings and ball bearings. Some of the standards of this class deserve wider use, however, as, for instance, the standard forged rod ends and yokes.

Then there is a class of standards relating to the joints or connections between parts that are often made in different plants. To this class belong the magneto standard already referred to, the carburetor flange standard, the bell housing standard and others. The value of these standards is so obvious that they have generally been adopted without hesitation. As a matter of fact, most of these standards were formulated at the request of parts manufacturers, and tractor makers had little to do with their adoption.

Fewer Tractor Screw Sizes

There has been in the past some talk of reducing the number of screw sizes for use in tractors. Why this would be an advantage is easy to see. One of the difficult problems in connection with farm tractors is that of maintenance. A tractor cannot easily be transported, and all ordinary repairs must be made right on the farm with the facilities available there. Now, it often occurs in the use of tractors that screws and nuts are lost or broken or have their threads stripped, so that they must be replaced. It would evidently be much easier for the farmer to keep a good stock of screws on hand if only a few sizes were

used. In all the ordinary screw standards the sizes vary in steps of 1/16 in. Why not cut out the odd sixteenth sizes in tractor manufacture? The direct benefit of simplification would not be limited to the farmers but would also be shared in by the manufacturer and the repair shop. There is, of course, one objection to the elimination of certain screw sizes. For instance, in places where a 7/16-in. screw would just suffice, a 1/2-in. screw would have to be used and thus the weight would be slightly increased. However, this disadvantage is far from offsetting the advantages to be gained, especially when it is considered that in some cases, by reason of the use of heavier screws a smaller number would serve the purpose. Very likely, different manufacturers of tractors are now following this plan individually, but if it has general approval, why not make it a standard or recommended practice?

Another item that deserves the attention of the tractor industry particularly at the present time is the methods of fastening lugs. Attention has already been called to the tendency to reduce tractor weight; now, in order to get sufficient traction with less weight it is quite important that the lug equipment be made as efficient as possible. Different operating conditions call for different lug equipment, and the farmer therefore finds it necessary to change lugs occasionally. With a standardized method of fastening, not only would the interchange of lugs by the farmer be facilitated, but inventors of improved lugs would find it easier to market them.

There is at the present time considerable research going on with respect to the best form of lug for different soil conditions. It is obvious that the minimum tractor weight permitting a given drawbar pull to be obtained depends to a large degree upon the lug equipment, and as reduction of tractor weight without reduction of drawbar pull spells increased efficiency, this development ought to be encouraged in every possible way.

Need of Co-operation

A few remarks of a general nature may not come amiss here. Standardization really signifies co-operative effort on the part of members of the industry, and no industry, perhaps, needs this co-operative spirit more at the present time than the tractor industry. During the war and the two years following it this industry enjoyed a sort of hot house growth, the direct result of high prices of farm products and scarcity of farm labor. Now conditions are practically reversed. Farm products sell at abnormally low prices and help is plentiful. The farmer has very little money to spend and he has no longer a prospect of an almost unlimited market for his products to encourage him to widen his scale of operations. In the past the desire to work an increased acreage was often the reason for the purchase of a tractor. Tractors retain all the advantages they ever had, such as ability to work to full capacity in all kinds of weather, lack of need for feed and care during periods of non-use, etc.; but their first cost and operating cost must be brought down in conformity with the changed economic conditions on the farms. Every manufacturer is equally interested in this problem and all should co-operate to solve it.

Standardization, while not a panacea for all the present woes of the tractor industry, will prove a powerful aid in solving its problems. It may be permissible to point to the automobile industry in this connection. There is no other branch of the mechanical industries to-day that is producing as efficiently as the automobile industry. It is not a mere coincidence that this industry also has carried standardization further than any other. Efficient production really means large scale production, because it is only in large scale production that really efficient methods are applicable. It is for this reason that a large proportion

of firms which have entered the automobile industry in recent years confine themselves to assembling. Their own output may not be so very large, but all the components which they use—the engine, transmission, axles, steering gear, etc., are made in parts factories on a generally much bigger scale. This plan of assembling would be greatly hampered—in fact, it would be almost impossible—if it were not for the standardization work of the S.A.E. To these parts factories belongs a great deal of the credit for the rapid advance in automobile design and for the efficient production methods in the automobile industry.

Summing up, there are three outstanding facts which should convince every tractor manufacturer that standardization is of value in the tractor industry:

1. This country's largest industry of manufactured products has standardized to a large extent and is keeping up the work.

2. During the late national emergency, the Government compelled standardization in many lines, because of the economic advantages to be gained.

3. European industrial countries, impoverished by the war, are turning to standardization as one means of re-establishing their economic balance.

The standardization movement would have been much further along by this time if it hadn't been for the more or less natural tendency among members of an industry to regard one another with distrust. As a rule, it requires some event of catastrophic nature to bring them together and make them see that they can accomplish more by pulling together than by each working for himself regardless of the others. The automobile manufacturers were first brought into a close union by the Selden patent situation, which was a real boggy during the early years of the industry. Many other industries learned the value of co-operation during the war. The slump in farm values is undoubtedly the greatest shock that the tractor industry has had so far, and it is to be hoped that out of the misfortune at least some good will come, that the tractor makers will see the advantage of co-operative effort, and of mechanical standardization as one of its expressions.

Four-Wheel Servo Brake

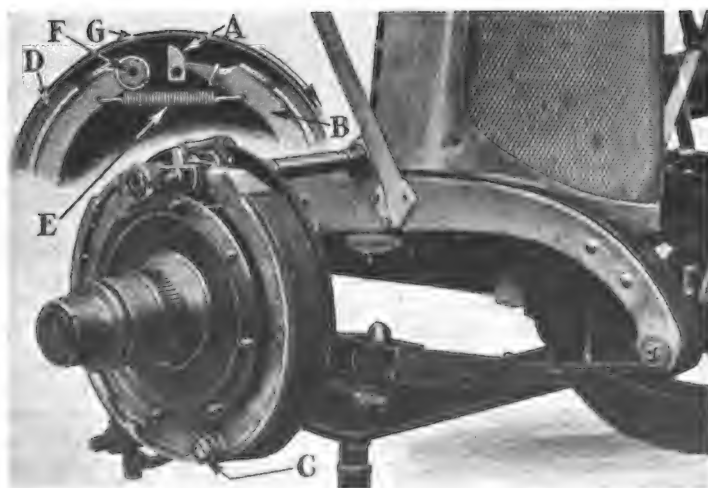
AN interesting and simplified form of servo-brake is used on the latest type of high grade six-cylinder chassis produced in the works of Farman Brothers, Paris. This car has four-wheel brakes operated simultaneously by means of a pedal, the control being on the Perrot principle. There are brake drums on each wheel, the inner brakes being hand-operated. This arrangement gives two independent braking systems, but without any braking effort going through the transmission.

The foot-operated brakes are internal expanding type, but are not mounted in the usual way, with a fixed point for each shoe and a cam to bring them in contact with the inner face of the brake drum. The brake cam A—as shown in the sketch—operates on only one shoe B, bringing it in contact with the face of the drum C. This brake shoe, which acts on the servo principle, is pinned to one extremity of the second brake shoe D, this latter having a fixed point at F. When brought into contact with the drum through the action of the brake pedal, there is a tendency for the first shoe to follow the rotation of the drum, thus pushing the second shoe and assuring the braking effort. This arrangement takes advantage of the inertia of the revolving parts without the use of any additional mechanism.

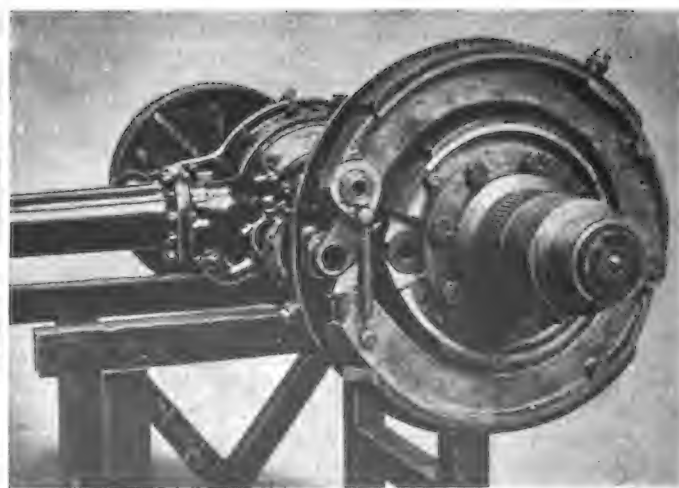
By mere alteration of the area of surface of the servo-brake it is possible, with uniform size drums front and rear and uniform brake shoes, to secure more progressive braking on the rear than on the front wheels. As the rear is less heavily loaded than the front when the brakes are applied, this prevents any tendency to skid and increases the life of tires.

An Encyclopedia of Airplane Engines

ONE of the latest books devoted to descriptions of airplane engines has been compiled by Glen D. Angle under the title "Airplane Engine Encyclopedia." In this book an effort has been made to briefly describe or at least refer to every airplane engine which has ever come to the author's attention. Most of the descriptions are necessarily very brief, but in a majority of cases a photograph and in many cases sectional line drawings of the engine are reproduced, while some of the major dimensions, the weight and power output are given in nearly all cases, and the special features of the engine are mentioned. The engines are listed in alphabetical order for ready reference. The book is published by the Otterbein Press.



Details of four-wheel brake—front



Arrangement of four-wheel brake—rear

Improvements in Gear-Box Design

Part II.

In this second article Mr. Orcutt tells the methods he employed to carry on special gear-box gear experimental tests and draws his conclusions. A detailed account is given of a new gear-tooth grinding process.

By H. F. L. Orcutt*

CONCLUSIONS drawn from some tests made on gear-box gears extending over a period of nine years in connection with the development of a special process of finish-grinding the teeth of hardened gears may prove of interest.

The number of gears dealt with runs into hundreds of thousands, including the so-called constant-mesh pinions. The sizes vary from a 15-tooth pinion to 60-tooth gears, the diametral pitches from 8 to 4, and the face widths from $\frac{3}{8}$ in. to $1\frac{1}{2}$ in. The materials include case-hardened, oil-hardened and air-hardened steels to varying specifications. The forms of teeth include the standard depths, and the stub tooth of varying pitches, with pressure angles from $14\frac{1}{2}$ deg. to 25 deg.

The tests were specially for quiet running, and were made as a part of production inspection. The gears were in each case tested with only one pair running, which were mounted on spindles set to exact center distance, secured on bushes or plugs which were hardened and ground, running dead true, great care being taken in all cases to have the two spindles dead parallel. The speed selected for the driving spindle was about 900 r.p.m. The spindles of the testing fixture are 4 in. diameter, of good length, running in bearings with very small clearances, all fittings being made with special care. The driving belt is $4\frac{1}{2}$ in. in width. A band brake, 3 in. wide, was applied to the driven spindle. The gears under test were run dry as well as lubricated by splashing with thin oil. The fixture itself ran without noise, and there can be no question but that any noise produced by these tests was purely a gear-tooth noise. Many of the tests have been made in direct comparison on the same fixture under identical conditions, with gears finished as accurately as possible before hardening.

The results of these tests can be briefly stated. The gears were made to run in all cases so quietly that if the same results could be secured in a gear-box it would be called noiseless on all speeds. Some of these gears ran remarkably quietly in boxes, but in very few boxes were they perfectly silent under running conditions on the road. In nearly every case they were more quiet than unground gears under load in the road test. In some cases the gears with perfectly accurately ground teeth are apparently just as noisy in the box as gears unground. In this comparison, however, the unground gears have always been subjected to special selection, stoning and very costly hand work on the teeth.

The conclusions submitted are as follows:

1. That gear-box gears which are hardened after finishing are always noisy.
2. That gears with teeth accurately finished after hardening are quiet.

3. That gears with teeth finished as accurately as possible may be noisy in the best finished gear-boxes.

4. That gears with teeth roughly finished may be under some conditions comparatively quiet.

5. That the accurately finished gear is just as essential to cheap and uniform production as the accurately finished cylindrical shaft or bearing.

6. That in a quiet running pair of gears the limits of accuracy on the teeth are the finest possible, much finer than are required in any other conjugate surfaces in the gear-box.

7. That in the ordinary gear-box the gear-teeth are usually the least accurate of any of the working surfaces.

8. That thorough development in gear-box design will not be possible unless all parts, including gear-teeth, are of accurate finish within known limits.

9. That some ratios run more quietly than others, tooth load and quality of finish being equal.

10. That the stub gear to run quietly must have extreme accuracy in tooth form, especially in pitch spacing. Consequently this gear is more difficult to finish to a degree of quiet running than the full depth tooth gear.

The tests recorded and the production work connected with them have demonstrated conclusively two things which are important to the motor car engineer. First, that in a gear giving the service required in the ordinary gear-box, if it is expected to run quietly, a perfection of tooth contact is necessary which it is hardly possible to secure by any of the ordinary gear-cutting methods. Second, that in the usual motor car gear, if it is hardened after the teeth are finished, the perfection of tooth contact necessary to quiet running is not possible. Further, in a gear with the teeth hardened after finishing the full possible tooth-wearing surfaces do not exist.

Unless these details are given full recognition, it is safe to predict that substantial progress in gear-box improvements will not be made, improvements which are desirable to put this unit in line with other parts of the motor car, and which, sooner or later, will be demanded by the public.

Much research work is necessary to determine minimum areas and sections of straight spur-gear teeth which, accurately finished and properly mounted, will run quietly under maximum loads. The known qualities so far demonstrated by test and usage are, that heat-treated gears made of special material with comparatively small straight spur teeth will stand high peripheral speeds and heavy loads, and have long life. Further, that such gears are, at a moderate cost, materially improved in running qualities when the teeth are accurately finished after they are hardened.

The following is an analysis of the sources of gear-box noises commonly observed:

1. Inaccurately finished gear-teeth impacts.

*Paper read before the Institution of Automobile Engineers, Dec. 15, 1921, condensed.

2. Ball or roller bearing influences.
3. Influences outside the gear-box, but which are manifest in the gear-box and come through either the front or rear connection.
4. The shape of the gear-box casing.
5. Weakness of gear shafts and weakness of casing.

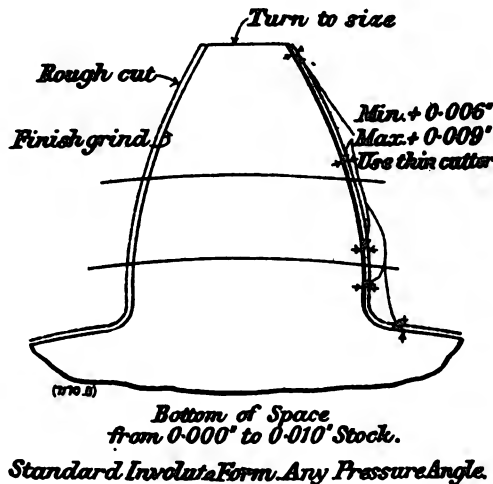


Fig. 2

6. The gear teeth being too small for the load.
7. Badly-mounted gears.
8. General bad workmanship in the box.
9. Periodic speeds in the engine.
10. Gear-box distortions caused by chassis movements.

The Gear Tooth Grinding Process

The process of gear-tooth finishing to which reference has been made is an entirely new mechanical operation, and a short description will probably be of special interest to the automobile engineer. The subject of finishing gear teeth is such a large one that it can only be dealt with in the briefest possible manner. Some of our best mechanical engineers have devoted years to the problems of machining spur-gear teeth and many of the mysteries of gear-tooth action still have to be solved. Some of the uncertainties have been cleared up in the development work which has been carried out in connection with the process to be described.

Gear-tooth grinding takes the place of the usual finishing cut on the milling, hobbing or generating machine. The cutting tool is an abrasive wheel correctly shaped to grind out the tooth space after the gear is hardened. The stock left for finish-grinding the teeth of the usual motor car gear should be enough to allow for the removal of all hardening distortions and such inaccuracies as may occur when the roughing cuts are reduced to the lowest cost. The teeth are finish-ground as a last operation with the gear truly mounted on bushes or mandrel which exactly fit the hole in the gear. The operations on a motor car gear are as follows:

- Operation 1. Bore and turn.
- Operation 2. Broach.
- Operation 3. Rough mill teeth.
- Operation 4. Round teeth.
- Operation 5. Harden or heat-treat gear.
- Operation 6. Sand blast.
- Operation 7. Grind hole to finished size, registering the hole from the bottom of the splines.
- Operation 8. Grind the ends of the hubs of the gear.
- Operation 9. Finish-grind the teeth.

In Fig. 2 details are given of stock to be left on the gear teeth for finish-grinding. With these allowances rough cuts for the tooth spaces need be nothing more

than a fast milling operation, and the highest possible distortions are allowed for.

(The author here describes the machine with which his experience has been had, which is an American product and has been previously described in these columns.—Editor.)

The form of tooth made use of is a pure involute, with no modifications whatever. Experience shows that the approach to accuracy in tooth finish coincides with the approach to silence.

A pair of gears with theoretically correct teeth should run silently unless overloaded or inaccurately mounted. It is found by many tests that the ordinary motor car gear which is hardened after the teeth are finished, is never accurate. It may be fairly quiet under certain conditions, but it is never of uniform quality.

The gear with ground teeth can be produced in quantities with a higher degree of accuracy and uniformity than by any other method, for several reasons. Firstly, on account of the fact that the tooth-form is controlled in the machine in which the gears are ground. Secondly, the refinements of tooth-finishing called for in a high-class gear must be within such very fine limits that no other cutting tool but the grinding wheel is capable of producing these refinements (these refinements include tooth forms, tooth-positioning and tooth-spacing). Of course, in the case of the hardened gear there is no cutting tool except the grinding wheel that can be used to give a uniform finish to the teeth. Further, the process lends itself to methods of inspection which are quite useless applied to the products of ordinary tooth-cutting machines.

In respect to the high-duty spur gear, the tooth-grinding process is specially important. By a high-duty gear is meant a gear which, with comparatively small tooth area, must carry a heavy load, run at high speeds, and have exceptional wearing qualities. Such a gear calls for a combination of material with special physical properties, with a finish of tooth form to a high degree of accuracy. The physical properties are at present only obtainable by using material which may be heat-treated or hardened, and this material can only be finished by a grinding wheel. When this cutting tool is used to finish tooth surfaces, the engineer has an unrestricted choice of material. He can specify physical properties which are impossible when the steel cutter is used as a tooth-finishing tool. The choice of material is important, as the action of mating gear teeth is at high speeds, under pressure, on a line only and always sliding. Under these conditions tooth abrasion will be rapid on any material if it does not have special physical properties.

Tests and actual running indicate that high peripheral speeds on straight spur gears can be adopted when they are made from high-grade material and with specially accurate teeth. It has been recorded that a peripheral speed of 10,000 ft. per minute is now being used on a certain service with satisfactory results. The maximum peripheral speeds usually recommended for straight spur gearing are not much over 2000 ft. per minute. Even with moderately high speeds the number of tooth contacts per minute is enormous. A sixty-tooth gear of five pitch, running at 1000 r.p.m., would have a peripheral speed of about 3000 ft., and 186,000 tooth contacts per minute. It is easy to understand that satisfactory running in such a gear could only be expected when the tooth contacts are as nearly correct as possible. Any variation whatever from correct tooth form adds to tooth contact, tooth impact—a vast difference at high speeds. Correct contact means silence;

impact means noise, varying with speed and force of blow.

A gear hardened after the teeth are finished loses a large percentage of its tooth contact through distortion alone. The larger the gear the more the distortion. Measurements have been made of numbers of such gears about 2 ft. diameter, 3 pitch, 5-in. face, in which the tooth contact was not more than 50 per cent of the full area. With the teeth ground after hardening the full tooth contact is secured, giving the gear a much longer life.

Beyond these general statements there are very few data available for high-duty spur gearing. What the engineer wants to know is the minimum tooth section which can with safety be adopted to carry a certain load at a specified speed, and the materials from which the gear must be made. Tests with gears with inaccurate teeth cannot be conclusive, and reliable data cannot be compiled from such tests. It is claimed that a complete investigation of gear-tooth phenomena on straight spur gearing is impossible through any other process than one in which the abrasive wheel is used for tooth-finishing. Further work is now being undertaken on ground gears, from which records will be compiled as fast as possible.

At present the gear-tooth grinding process can only be made use of in a centralized plant, and to this there is on the part of some motor car makers an aversion. This aversion is perfectly natural and reasonable, and the attitude of the owners of the patents covering the gear tooth and splined shaft grinding machines should

be explained. Ten years' work in production for the trade and in the development of the process has proved one thing which is not easy to understand, that is, that the plain spur gear, as used in the ordinary gear-box, will not run quietly unless the teeth are finished with refinements which cannot be maintained by the tooth-cutting methods commonly in use. These refinements are so extreme that even with the process now employed in gear grinding, special experience and a special staff are necessary to maintain a proper standard of workmanship on the gear teeth and the splined shaft. Further research work is necessary. This work is necessarily linked up with production, and for the time is naturally the occupation of a special staff and a specially organized equipment. The principle of working in a centralized plant has been accepted as the only one by which success could be assured in developing a new mechanical operation.

It is particularly interesting to note that the indispensable qualifications of a good high-duty gear and a good ball bearing are exactly comparable. Both must be made with a high degree of accuracy, with very fine limits of error and of specially selected and treated material. They must be correctly mounted to give good running results. A large amount of educational and instructive work has been done in connection with ball bearings before its economies were understood. The same work must be done for the accurate gear before the full possibilities of the high service it will give are commonly accepted.

(To be continued)

Steinmetz Double Reduction Spur Gear Axle

PRODUCTION will soon begin on the Steinmetz electric truck. The present model has a capacity of 1500 lb. and is simple in design and has an abundance of power. The motor and rear axle are of special design. Other parts of the car are of a conventional design.

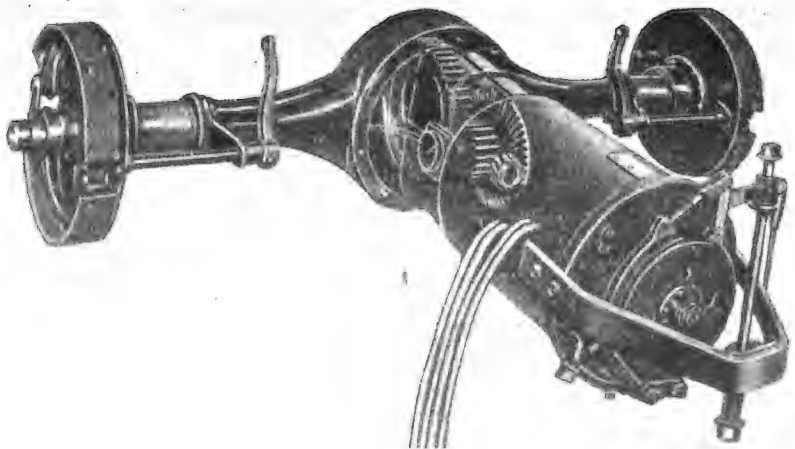
Since he first became interested in the electric vehicle, Steinmetz has attacked the motor and gear reduction problems as those which were the most poorly adapted parts of the chassis. The high speed at which the electric motor operates efficiently makes it necessary to have a high gear reduction, which is objectionable in this kind of a vehicle. His first designs called for a revolving field rotating in an opposite direction to the armature. This was found to be impractical from a service standpoint, and the gear reduction is accomplished in this latest design in a double reduction spur gear axle of which the motor is a unit part.

While no definite price has as yet been set on the vehicle, it is said that it will probably be near \$1,600 for the chassis. One of the innovations in electric truck merchandising will be the adoption of a standard battery, so that when the price is determined it can be quoted. Past practice has been to have so many options in battery and equipment that no very definite price can be held in the mind of the purchaser or prospect.

The truck is fitted with pneumatic tires, 33 x 5 in. There is a hood in front of the driver's seat resembling very much the hood on a gasoline truck. A

portion of the battery is contained under this hood and another portion is under the driver's seat. Both sections of the battery are contained in trays and can be rolled out of the car in a very few minutes by simply disconnecting the leads and loosening the clamp bolts.

A PRACTICAL correspondence course in the efficient use of coal, gas and liquid fuel is now being given by the Hays School of Combustion. As we understand it, this course is primarily intended for those interested in steam power or various classes of heating plants, in which the fuel is frequently burned in a most inefficient manner.



Detail view of Steinmetz rear axle and motor unit, showing double reduction drive

Correlation Between Metallurgical and Service Tests

Prominent British metallurgist discusses the need for greater co-operation between those of his profession and automotive engineers with a view to developing tests the result of which can be used with greater certainty of success in selecting the most suitable metals for various purposes.

By Dr. Walter Rosenhain

THE recent and present advocacy of the employment of various aluminum alloys in automobile construction has raised anew a fundamental question which must always enter into consideration when a new and comparatively unknown material is suggested as a substitute for an old well-known and well-tried one. The question is, how does the proposed new material compare with the old in regard to those qualities which "count" for the particular purpose for which it is to be used? And it is the answer to this question which must decide, in the first place, whether the new material is to be used at all and, if so, in what quantities it is to be used—i.e. the dimensions of the parts to be made of it. Yet, frequently as such a question must have arisen in the past, there is none more difficult to answer, and the difficulty is by no means confined to the metallurgist who has explored the properties of new alloys.

After all, the answering of our question must depend in the first instance upon a knowledge of what are the physical properties of the material which really do "count" for a given purpose, and that is a question which the engineer or designer is rarely able to answer in really precise terms. On the other hand, the metallurgist in investigating a new material is confronted with equally serious difficulties of his own; methods of testing which appear reliable and exhaustive with one type of material prove far from satisfactory when applied to another, and sometimes the only way to bring out the real value of a new material is to devise some entirely new form of test. When this is done, the difficulty arises of how the results of such a test are to be interpreted. It is obvious, therefore, that in this, as in so many matters, what is required is the closest possible co-operation between metallurgist and engineer.

Present Test Methods Inadequate

Looking at the whole matter broadly, it appears that this very difficulty of estimating the relative values of widely different materials for a given purpose of construction in reality constitutes the severest indictment of the efficiency of our current methods of testing materials. If those tests were really sufficient to tell the engineer precisely how a material would behave in service, then such difficulties would not arise. In practice it must, unfortunately, be admitted that even exhaustive tests of the types now in vogue do not furnish all the desired information and the engineer must still, to a considerable extent, rely upon the test of actual service.

If the nature of mechanical tests is considered, it is

not really surprising to find that they do not, and in their present form, cannot, furnish all the information needed. There is, first of all, the vital question of the reliability of a given material to be considered. Of this, the testing of a comparatively few samples chosen at random can scarcely give more than a vague indication. An internal defect here or there may easily escape detection or notice in any series of tests. When such tests are made upon material which has been experimentally produced for purposes of investigation, the occurrence of occasional defective test-pieces would naturally be regarded as an inevitable incident of experimental work. But the vitally important question arises, when a new material comes to be taken into practical use, whether it can be consistently manufactured with reasonable freedom from such defects.

From the metallurgical point of view it is probably true to say that materials produced in the wrought condition—i.e. as rolled sheets or bars or as forgings, freedom from internal defects can be assured by proper manufacturing precautions, mainly because defects generally make themselves felt during the manufacturing operations themselves. With castings, the problem is much more difficult. Some alloys present very great difficulties where the production of sound castings, particularly of difficult shapes, is desired. Where the skill of the founder is aided by rational design which does not demand castings of unfavorable form, these difficulties can generally be overcome.

Reliability Determined by Service Tests

It is, however, very difficult to see how any test other than the costly one of service experience can be devised which can furnish the engineer with data on this point of reliability. It follows that, from this point of view alone, the use of new materials must involve a certain speculative element. It is the intelligence and enterprise displayed in taking these risks that mark the progressive engineer; had they not been taken in the past, the present development of engineering practice could never have been attained. The step involved in passing to an entirely different type of materials, such as an aluminum alloy as compared with steel, is of course, very considerable. But it is quite probable that the progress of the metallurgy of the light metals and alloys will shortly confront the engineer with new types of material even more startlingly different in their properties than are the aluminum alloys already available.

This consideration adds urgency to the other aspects of our question, which may be summed up in the single

query: "What do our mechanical tests really mean?" We are told that a new material which is offered for constructional purposes gives certain tests. If it has been exhaustively studied by the available methods, we shall be furnished with data on tension tests, shear, compression, single and multiple-blow impact, fatigue, hardness and similar matters. When a metallurgist investigating a new alloy has obtained these data, he has done—from that point of view—very nearly all that can be done with existing methods.

Engineering practice, which relies upon a few tests selected from this list for the routine acceptance testing of its materials, confirms this conclusion. Yet, with all these data, can the engineer be really sure how the material will behave when used for a given purpose? The answer is, in the majority of cases, "no." If the tests are good all round, one will naturally feel some degree of confidence in the material and its tentative application will be encouraged, but a quantitative comparison with an old material of known service capacity is still not possible. Two widely different materials giving similar tensile tests and impact-test figures may yet behave very differently if exposed to shock or vibration. In most cases, too, the test data of a new material will not appear entirely "good all round"—there is frequently a price to be paid for an advantage gained in one direction by a lower test-figure in another. Can any one say at the present time what the true "exchange value" of these figures is, even for a single well-known type of material?

The controversy which is not yet at an end in regard to the relative importance of high elastic limit and high notch-bar impact figure in alloy steels shows very clearly that exact knowledge on such a point has not yet been achieved—and this, be it noted, is a joint and equal responsibility as between the engineer and the metallurgist. It is futile for either to suggest that it is the business of the other to settle these matters.

One reason why our knowledge of the fundamentals in these matters has not progressed as far as could be desired is that the attention of engineers and metallurgists in regard to mechanical testing has to a very great extent been concentrated hitherto upon one material or group of materials which possess a fairly definite correlation of physical properties. Ordinary steels, which for so long a time constituted the main materials of the great mass of engineering construction, have been very extensively studied and long experience has set up a certain amount of knowledge as to the relation of service behavior to mechanical test results. It must be admitted, however, that a good deal of this correlation is rather of the nature of tradition than real definite knowledge. Otherwise, how comes it that there is, at this time, a definite divergence of opinion upon so simple a question as the proportion of sulphur and phosphorus which can be safely admitted in certain types of steel? American and British practice differ widely in this matter, and neither is based upon any really definite data. The same remarks apply in other directions, and the insufficiency of our knowledge of this matter is reflected in widely differing specifications and in the occasional

failures of parts arising from causes other than specific defects or wrong treatment of the steel.

We may sum up the matter in regard to steel by saying that through enormously extensive testing and the gradual accumulation of knowledge and impressions in regard to the service behavior of the material, we know something of the correlation of mechanical tests to service behavior in the case of steel, but even this knowledge is by no means complete.

The extensive use of alloy steels of various kinds has served to open up this question very acutely, and particularly in regard to the construction of light machinery such as the internal combustion engine intended for use on automobiles or airplanes. Here it became a question—particularly in regard to aeronautical engines—of utilizing materials to the fullest possible extent and the cost of more extensive testing and fuller investigation could well be borne. It very soon became evident, however, that the somewhat vague correlation between mechanical tests and service behavior which forms the basis for the existing use of ordinary steel, could not be extended without careful consideration and investigation

to alloy steels of, apparently, much higher strength. An alloy steel showing more than twice the tensile strength of a given carbon steel, could not be exposed to anything like twice the working stresses. The rapid rise in importance of fatigue and shock tests has been due very largely to this factor, which led to the realization that it had now become necessary to know a great deal more about our various materials.

A whole series of empirical mechanical tests has consequently been developed and the results furnish the metallurgist and the engineer with a mass of data which they find it difficult, if not impos-

sible, to interpret in any really exact manner. When, as at the present time or in the near future, we have to extend our vision to include light alloys of aluminum or of still less-known metals, the step is a much larger one. The correlation between test and service in the case of ordinary steels is adequate for working purposes; in passing to alloy steels we find it far less complete and our use of those materials remains correspondingly tentative until experience has gradually furnished us with adequate knowledge or tradition. In passing to light alloys we have to take a still longer step and need not be surprised to find ourselves in territory which is more difficult to explore. Metallurgist and engineer must therefore move forward together, with some degree of caution and using such knowledge as they both possess by way of guide.

Out of the very real difficulty which exists in interpreting the results of current mechanical tests, two schools of thought have arisen. The followers of one seek to overcome the difficulty by trying to devise tests which shall imitate service conditions as closely as possible in the hope that the imitation may be made close enough to furnish data which can be translated with approximate accuracy direct from the testing machine to service conditions. If this aim could really be achieved, the method might well serve as a temporary bridge to cover the existing gap in our real knowledge. It is, of course, at best little more than a method of trial and error. Its

WHAT physical properties of the various metals used in automotive construction render them most suitable for the service to which they are put? This pertinent question and others of a closely related character are not easily answered, largely because tests now in common use do not fully simulate service conditions. On the other hand, actual service tests are expensive and seldom lead to conclusions applicable in other cases. The author here discusses the problem from various angles, but admits that its solution is far in the future, though steps in the right direction are being taken through research work and co-operation between the engineer and the metallurgist.

advocates say, in effect, that they do not care in the least why or how a given part stands up to its work, so long as they can be sure that it really will stand up.

For immediate practical purposes such an assurance would no doubt be extremely valuable, but—it leads no further. Every modification of design or use which alters the conditions must then demand a new "imitation" test. We see this type of experimenting carried to a very high pitch in the use of the model tank for ship-design and of the wind-channel for the testing of airplanes and airship models. There, however, the laws of similarity allow of a scientific interpretation of the results and not only tests of immediate empirical importance, but systematic data leading to the formulation of fundamental principles can be obtained. Unfortunately, the difficulty of the "model" or "imitation" type of experiment are enormously greater in the case of materials and parts of construction.

The real difficulty lies in the time factor. Any "model" or "imitation" test must, if it is to be of real service for practical purposes, furnish its results in a few hours or at most a few days. Yet actual service conditions, which it is desired to imitate are such that failure does not occur, at all events until after the lapse of many thousands of hours, or—ideally—not at all. It follows, therefore, that any such "imitation" test must also be one in which the destructive forces are accentuated in order to bring about failure in reasonable time. This accentuation of the forces, however, completely destroys the value of the test, because it does not in the least follow that a given part which fails somewhat rapidly under intense forces in a test will therefore be less serviceable under the lower stresses of actual service. The apparent order of merit of a whole series of materials may be entirely reversed by merely altering the conditions of test in such a way that in one case failure occurs in a few minutes while in the other many hours are occupied. Therefore, although it is not suggested that tests of the "imitation" type are not at times useful as giving indications of behavior under complex conditions, yet they cannot be regarded as furnishing a satisfactory bridge over the gap between the testing machine and service behavior. The closeness of the imitation is not, and in the nature of things can scarcely be, sufficiently good to furnish reliable data.

The recognition of this conclusion forms the basis for the views of the other school of thought, which considers that progress along two closely related lines is required in order to bring about the desired advance in our knowledge of materials and their behavior in test and in service.

In the first place there is needed advance on the

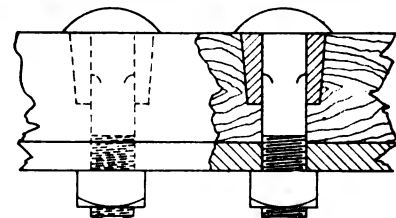
purely engineering side toward a closer analysis of the actual forces operative in the various structures and parts employed. This analysis is, of course, only possible with a concomitant advance in our knowledge of the exact behavior of our materials under moderate and medium stresses, lying not only well within but upon the border line of the elastic limit of proportionality.

On the other hand, advance in testing methods is equally required, and this should take the form of their simplification with a view to the determination of individual physical constants of the material rather than—as is done in many current tests—determining the behavior under some complex system of stresses. This is, of course, a counsel of perfection, since the advance required in both directions is very great. None the less, research activities are now so keenly active that rapid advance might be anticipated were the real value of such work realized. At the present time, a large amount of time and energy are, from this point of view, wasted upon the carrying out of complex systems of testing which do not really advance our fundamental knowledge of materials to any appreciable extent.

In view of the long distance to be covered before the desired end can be obtained by the fundamental methods just outlined, it may well be asked how the immediate difficulties are to be attacked? It is obvious that neither metallurgist nor engineer can await these developments, and immediate practical policy must be determined. This must be left, to a great extent, to the judgment and experience of the individual. That "vague correlation" which has been referred to in connection with steel, has—after all—done excellent practical service. Although it is not to be regarded as ultimately satisfactory, and though its present limitations are sometimes very evident, yet it serves for most purposes—the gap being covered by large "factors of safety" applied consciously or unconsciously in practice. And until the deeper fundamental knowledge becomes available, this same method must remain the only one which can be applied to new materials. Their use can, at first, be only experimental and tentative. Engineer and metallurgist must work together, exchanging all the information at their disposal. The application of new materials is necessarily an experimental matter; the experimental work must be regarded as beginning in the laboratory or the works of the metallurgist, but it must look to its completion at the hands of the engineer. It is not until the engineer has determined whether the material can be used for certain purposes and how it is best used, that the joint achievement of metallurgist and engineer in the development of a new material can be regarded as crowned with success.

Steel Bushings for Bolts Passing Through Wood

TO overcome the difficulty of bolts passing through wood turning in the wood a steel bushing may be used, with a squared hole where the bolt head or the squared part below the head comes. Such bushings are being marketed under the name Harbuck bushings and are made in sizes suitable for from $\frac{1}{4}$ - to 2-in. bolts. They may be used in connection with carriage bolts, countersunk head carriage bolts, deck bolts and machine bolts or cap screws. The action of the bushing on all types of bolts is the same. A flush surface is obtained with all but the common carriage bolt construction. The use of these bushings is said to be particularly advantageous where the part or mechanism is subjected to shock or vibration or where it is necessary to take the



Harbuck bushing on carriage bolt

bolt out and replace it frequently. Where the bolts and bushings are subject to corrosion, non-corrosive metals are used.

Results of the Nebraska Tractor Tests, 1921, Conducted by the University of Nebraska—Department of Agricultural Engineering—Lincoln, Nebraska

No. of Test	TRACTOR		MOTOR				BELT TESTS														Var. L. 1 Hr.				
							RATED LOAD TWO HOURS							MAXIMUM LOAD ONE HOUR											
	Name	Rating	Weight	Cylinders	Size	R. P. M.	Make	Average H. P.	Average R. P. M.	Kind	Fuel		Temperature		H. P.	R. P. M.	Kind	Fuel		Temperature		R. P. M.			
											Gallons Per Hour	H. P. Hours Per Gallon	Water—Gallons Per Hour	Air				Rad.	Gallons Per Hour	H. P. Hours Per Gallon	Water—Gallons Per Hour	Air	Rad.	High	Low
70	Minneapolis.....	17-30	6,400	4	4½x7	775	Own.....	30.07	775	K...	3.46	8.70	1.00	75	208	31.95	782	K...	3.91	8.18	3.96	80	210	861	776
71	Avery.....	12-25	7,500	2	6½x7	700	Own.....	25.20	704	G...	3.12	8.08	8.00	70	210	25.08	703	G...	3.46	7.25	8.00	79	210	893	695
72	Avery.....	8-16	4,900	2	5½x6	750	Own.....	16.66	758	G...	2.15	7.76	5.50	76	210	16.76	753	G...	2.29	7.33	4.00	71	205	815	740
73	Wetmore.....	12-25	3,000	4	4 x 5½	1,265	Weidely.....	25.27	1,253	K...	3.05	6.95	0.00	72	195	27.94	1,264	K...	3.46	8.08	0.64	70	206	*1,280	1,246
74	Huber "Super 4".....	15-30	6,090	4	4½x6	1,000	Midwest.....	30.34	1,010	G...	3.29	9.23	0.08	82	181	39.79	1,014	G...	5.00	7.95	0.18	81	183	1,090	1,006
75	Lauson.....	12-25	4,900	4	4½x5½	1,200	Midwest.....	25.21	1,214	G...	2.96	8.53	0.42	75	164	37.38	1,219	G...	5.17	7.23	0.52	64	158	1,209	1,213
76	Best "60".....	35-55	17,500	4	6½x8½	650	Own.....	56.09	656	G...	6.97	8.05	5.00	90	209	56.33	655	G...	6.90	8.16	7.00	94	209	974	650
77	Best "30".....	18-30	7,400	4	4½x6½	800	Own.....	30.40	810	G...	4.55	6.08	1.50	77	201	30.43	806	G...	4.31	7.06	2.50	86	203	1,227	796
A	Shawnee {Power Patrol	30-60	22,180	4	8 x10	525	Own.....	60.35	534	K...	11.98	5.04	7.63	100	200	66.13	532	K...	16.18	4.09	6.00	107	200	600	529
	Russell "Giant"																								
78	Russell "Giant"	—20	4,110	2	5½x6½	800	Own.....	20.12	808	K...	2.27	8.86	1.00	87	190	23.01	811	K...	2.56	9.00	1.29	84	183	858	808
79	Hart-Parr.....	16-30	7,210	2	8 x8	500	Own.....	30.25	505	K...	3.65	8.28	2.35	95	185	31.80	503	K...	4.24	7.50	2.68	87	172	605	496
80	Eagle.....	12-22	6,090	2	7 x8	500	Own.....	22.41	507	K...	2.83	7.92	2.00	81	191	23.35	503	K...	3.18	7.34	2.12	90	191	555	501
81	Allis-Chalmers, 12-20.....	14-27	4,550	4	4½x5½	1,100	Midwest.....	27.28	1,102	G...	2.81	9.71	0.26	98	180	33.18	1,105	G...	3.86	8.60	0.34	85	181	1,238	1,074
82	Allis-Chalmers, 18-30...	22-38	6,640	4	4½x6½	930	Own.....	38.62	942	G...	3.94	9.81	1.16	87	169	43.73	937	G...	4.72	9.27	0.97	77	173	1,080	937

No. of Test	TRACTOR		DRAWBAR TESTS														Mis- cellaneous				
			RATED LOAD TEN HOURS										MAXIMUM								
	Name	Rating	Weight	H. P.	Pull Lbs.	M. P. H.	Engine Speed R. P. M.	Wheel Slip %		Gear Used	Lugs Used	Fuel		Water— Gallons Per Hour	Temperature		Pull Pounds	M. P. H.	Total No. Hours	Lub. Oil Gal.	
								Pt. of Lugs	Face of Rim			Kind	Gallons Per Hour		H. P. Hours Per Gallon	Air					Rad.
70	Minneapolis.....	17-30	6,400	16.88	3,065	2.06	790	11.90	2.02	Low..	Angle.....	K.....	3.46	4.87	0.50	64	179	3,921	1.88	35	8 1/2
71	Avery.....	12-25	7,500	13.77	2,441	2.12	684	9.60	1.50	Low..	U-Cleats.....	G.....	3.87	3.56	5.00	83	210	2,500	2.02	35	8 1/2
72	Avery.....	8-16	4,900	8.23	1,366	2.26	783	12.00	2.40	Low..	Spuds.....	G.....	1.92	4.28	3.55	71	209	1,690	2.22	42	10 1/2
73	Wetmore.....	12-25	3,000	13.28	1,477	3.37	1,235	14.00	5.60	Inter..	Angle.....	K.....	2.88	4.61	0.04	62	176	2,260	2.67	32	6
74	Huber "Super 4".....	15-30	6,090	17.27	2,264	2.86	1,004	9.10	—2.70	Low..	Cone.....	G.....	3.14	5.49	0.14	76	173	3,645	2.76	32	4 1/2
75	Lauson.....	12-25	4,900	12.81	1,599	3.01	1,175	8.70	—2.60	High..	Spade.....	G.....	2.75	4.64	0.22	71	152	2,985	2.63	32	3
76	Best "60".....	35-55	17,500	35.31	5,093	2.60	692	1.25	—4.46	High..	Crawler.....	G.....	6.66	6.24	0.16	86	187	7,500	2.44	45	23 1/2
77	Best "30".....	18-30	7,400	19.75	2,537	2.92	810	0.70	—4.46	High..	Crawler.....	G.....	3.77	5.24	2.55	82	202	2,445	3.11	47	19
A	Shawnee {Power Patrol	.....	4,250	5.85	1,293	1.70	1,492	17.80	9.30	Low..	Angle.....	G.....	2.21	2.65	0.03	80	202	1,648	1.71	32	3 1/2
	Russell "Giant"	30-60	22,180	30.60	5,656	2.03	574	5.10	—0.60	Low..	Angle.....	K.....	11.64	2.56	5.45	79	166	8,800	1.85	40	22 1/2
78	Hart-Parr.....	—20	4,110	11.23	1,406	3.00	760	7.04	—6.98	High..	Spade.....	K.....	2.07	5.42	0.58	87	190	1,690	2.97	30	2 1/2
79	Eagle.....	16-30	7,210	17.15	2,116	3.04	460	4.74	—7.64	High..	Spade.....	K.....	3.12	5.49	1.10	87	194	2,200	3.00	38	4 1/2
80	Eagle.....	12-22	6,090	12.81	1,553	3.09	469	5.10	—6.80	High..	Spade.....	K.....	3.10	4.13	1.90	83	180	1,665	2.92	47	4 1/2
81	Allis-Chalmers, 12-20.....	14-27	4,550	15.13	1,771	3.20	1,094	7.58	—4.46	High..	Spade.....	G.....	2.60	5.32	0.23	91	168	2,560	3.14	41	7 1/2
82	Allis-Chalmers, 18-30.....	22-38	6,640	23.72	2,780	3.20	951	10.80	0.15	High..	Spade.....	G.....	4.00	5.92	0.27	79	167	3,075	3.10	41	9

*Hand controlled.

Test No. 70. Minneapolis 17-30. Own governor. "Dixie" "H T 46" magneto, Kingston "E" carbureter. Fan belt adjusted. Clutch and valve rods adjusted once.

Test No. 71. Avery 12-25. Own governor, K-W "T K" magneto, Kingston "E" dual carbureter. Ground one exhaust valve. Replaced original plugs by long skirted plugs. Pistons were turned down 0.005 in. Compression low on rear cylinder. Changed from kerosene to gasoline tractor.

Test No. 72. Avery 8-16. Own governor, K-W "T K" magneto, Kingston "E" dual carbureter. Pistons turned down 0.006 in. Ground all valves. Ground exhaust valve front cylinder. Relieved all piston rings. Charged to gasoline tractor. Kerosene gasifiers replaced by gasoline adapters.

Test No. 73. Wetmore 12-25. Weidely governor, Splittorf Aero magneto, Schebler "AT" carbureter. No adjustments or repairs.

Test No. 74. Huber Super Four. Taco governor, Kingston "L D 4" magneto, Kingston "L" carbureter. Cleaned carbureter. Replaced magneto; old one had poor contact points. Changed all plugs.

Test No. 75. Lauson 12-25. Taco governor, Dixie "46 C" magneto, Kingston "L" carbureter. Replaced all spark plugs. Tightened clutch. Broke clutch shoe.

Test No. 76. Best "60." 35-55. Own governor. Bosch "Z R 415" magneto, Ensign "G" carbureter. Valves were ground. Air cleaner removed. Changed carbureter horn from 2 in. to 3 in.

Test No. 77. Best "30." 18-30. Own governor, Berling "E Q 41" magneto, Ensign "G" carbureter. Magneto timing advanced 5 deg. Inlet in carbureter drilled to standard size, original opening too small. All valves were ground. Steering clutches adjusted. Steering arm broke.

Test No. 78. Russell Giant 30-60. Pickering governor. Bosch "D U 4" magneto, Kingston "E" dual carbureter. Fan belt replaced. Tightened fan belt. Belt lagging came off pulley. Radiator replaced by larger one. All valves were ground. Clutch adjusted. Valve spring broke and was repaired.

Test No. 79. Hart Parr 20. Own governor, K-W "T K" magneto, Stromberg "M" carbureter. Fuel line cleaned. Breaker points on magneto readjusted.

Test No. 80. Eagle 16-30. Own governor. Dixie "462" magneto, Schebler "A" carbureter. Adjusted clutch. Cap came off connecting rod grease cup. Burned out right connecting rod bearing.

Test No. 81. Eagle 12-22. Own governor. Dixie "462" magneto, Schebler "A" carbureter. Magneto timing advanced. Carbureter float adjusted. Pistons replaced by higher compression type. Cotter key in end of transmission drive shaft sheared off. Connecting rod grease cups came loose unless tightened with pipe wrench. Bolt came loose on shift bar. Air intake pipe diameter increased to 3 in.

Test No. 82. Allis-Chalmers 12-20. (14-27.) Own governor. Dixie "46 C" magneto, Kingston "L" carbureter. Gasoline feed line broke at tank. Carbureter cleaned. All valves ground. Magneto timing retarded. Two spark plugs replaced and all plug points adjusted. Cylinder blocks removed and top rings on pistons 1 and 2 found sticking. Oil pipe line broke.

Test No. 83. Allis-Chalmers 18-30 (22-38). Own governor. Elsmann "G 4" magneto, Kingston "L" carbureter. Carbureter float adjusted. Clutch fork replaced. Carbureter replaced. Air washer redesigned and air space increased. Water tank connected to air washer.

Test A. Shawnee power patrol. Road grader. LeRoi governor. Berling "E 41" magneto. Schebler "AX 66" carbureter.

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The Future of Commercial Aviation

Views of two authorities which were expressed at the recent British Air Conference. In this article one gives an outline of what must be done if commercial aviation is to progress, while the other shows a comprehensive survey of civil aviation in the different countries.

IF civil aviation is to have any future there is only one way and that is to carry more passengers and yet more passengers. Given even a moderate percentage of traveling public, civil aviation could be made to pay its own way within five or six years." This is the immediate future of civil aviation as expressed by Lieut.-Col. W. A. Bristow in his address before the British Air Conference, Feb. 7, 1922.

Col. Bristow goes on: "On a basis of a week of seven days the minimum number of passengers necessary for the profitable operation of any one company engaged in aerial transport is not fewer than 500, and these must be carried in the most efficient machines operated by an exceedingly skilled and highly organized personnel. There are many who will consider this figure excessive, but probably few will dispute the statement that the present number of passengers must be increased several times over before the business of aerial transport can be carried on at a profit without the assistance of subsidies."

Col. Bristow has in mind, of course, aerial transport between London and Paris, where three French and two British aerial transport companies operate, but all with subsidy assistance, which alone has made a continuation of the service possible. Drawing attention to the impossibility of any aerial transport, carrying few passengers, and attempting to operate without a subsidy, Col. Bristow adds: "What other transport company could afford to keep a staff of such proportions for fewer than fifty passengers per week, taken as an average over the entire year? In some aerial transport lines the persons employed on the working of the fleet number more than the passengers carried. No other form of transport could live long under such conditions, however efficient the vehicles or methods."

Col. Bristow is firmly convinced that the lack of passengers in sufficient numbers to make aerial transport a financial success, is due to a fear of accident by the traveling public, and that a broad educational program is essential before subsidies can be discontinued. Here are his views:

"By what means are we to attract the far greater number of passengers necessary? At present no real concerted effort is being made by the operating companies to attract the public. Much of the advertising and propaganda of the operating companies is aimed at securing as big a share as possible of the numbers already traveling by air, but little if any to encourage the general use of the air way. Before we could answer the question as to how to increase the number is to be done, it will be necessary to try to form some idea as to the main reasons that keep the public back.

"It is considered that the chief reason lies almost wholly in the fact that insufficient attention has been concentrated upon the problem of making flying really safe, and secondly we have not made it look and feel as if it is. I am now not speaking of any one company, or of even any one country, but as a result of a close examination of the

commercial air fleets of the world, and after talking with hundreds of passengers and timid inquirers after knowledge, I am forced to the conclusion that the question of safety is the most important, and the one most urgently calling for treatment, if even a moderate proportion of the traveling public is to be converted.

"We are rather apt to think that the public know little of the factors determining safety in flight, and that to them all airplanes are very much alike. Experience has shown this idea to be completely erroneous. The author has heard many conversations that show the contrary to be the case, and on more than one occasion has witnessed passengers refusing to travel in a machine which they did not consider safe or sufficiently comfortable.

"The experience of last year has revealed several points that require serious attention, even although the number of fatalities and injuries are low, and in the case of the British the cross-channel service was actually nil. As, however, all companies have to suffer if anything impairs the confidence of the public, it is necessary to survey the European services generally, and the operations of some have undoubtedly given cause for considerable misgivings. Probably the most serious cause of accidents has been lack of skill and judgment on the part of the pilots, although it is necessary to except the British pilots from this generalization.

"On the Continent and in America, however, there is considerable room for improvement, not only in the flying methods but in the qualification deemed necessary by the operating companies for pilots that are to be entrusted with passengers to be taken on long and difficult routes. It seems almost impossible, but it is a fact, that pilots are sent off with passengers on long routes over which they have never flown before to land on airdromes they have never seen. It is considered by many that the question of training of suitable pilots is one calling for the most serious attention by all those concerned with the control and operation of commercial aerial transport."

Commercial aviation as carried on up to the present can scarcely be taken as a criterion of what the future of it will be, and Col. Bristow considers "it a probably fair statement that commercial aviation has up to the present been little more than a full scale experiment with apparatus largely of a makeshift and temporary character."

He goes on: "In spite of these limitations the results have been of an extremely interesting and valuable character, and the greatest credit is due to those who have in face of serious difficulties carried ever-increasing loads with factors of regularity and safety of a high order."

In the first place, he continues, "We have to recognize that at present it is not possible to carry on the business without a subsidy in some form or another, and therefore the character, allocation and working of the subsidy system, will have a most important effect on development. . . . The London-Paris route has been one of the best in Europe to experiment with and operate on a subsidy basis. It possesses inherent advantages not to be found

elsewhere. It is about the right length for severity of test, the wide strip of water necessitates a high standard of reliability, and the rapidly fluctuating weather conditions along the whole route compel the rapid development of the two great guardian services of aviation, namely, meteorology and wireless telegraphy and telephony. In addition, the two termini, London and Paris, and the general operations on the route are controlled by different countries with different ideas and methods, and no doubt much of the progress that has been made is due to the mutually instructive effect by such an arrangement. Regarded as an experimental laboratory for the instruction of designers, constructors and operators, an international route is almost bound to be of greater value than any purely national one.

The London-Paris Route

"From a commercial standpoint, the London-Paris route has great advantages. The actual journey by land and water, with its changes, delays and vexatious examinations, is rendered far more troublesome than its mere length would indicate, and very few people who have experienced the convenience and speed that can be obtained on this route, in any reasonably suitable airplane, will feel inclined to revert to the old means of travel. The number of passengers is enormous, and in addition to the subjects of the two countries there are scores of travelers and visitors from every country in the world who yearly pass between the two capitals.

"There are hundreds of routes that could be opened up to air traffic to advantage but it is considered that success in these will best be assured by first hammering out the many technical and commercial difficulties on our own doorstep, and the Paris-London route is especially suitable for this purpose."

Col. Bristow is firmly convinced that commercial aviation will have a greater influence on military air craft than the latter will on commercial development. He believes that progress in flying generally and especially in connection with the design of machines and engines, depends largely upon actual flying experience, and already most of the flying all over the world is done by commercial aircraft. Progress in designing military aircraft is, therefore, to an important extent, directly dependent upon the rate of evolution of commercial aircraft. Further, and this is of vital importance, it is considered that progress can only be continuous if the ranks of aeronautical engineers are constantly replenished with new blood.

Commercial Aviation Aid to Military

On this Col. Bristow says: "It is hardly possible that the profession of aeronautical engineering can be built up on the requirements of military aircraft alone, so that it may well be that the future superiority of British naval and military air fleets will depend mainly upon the growth of commercial aviation, although the actual differences between civil and military aircraft may be as great as that between a Hood superdreadnaught and a Mauretania."

Col. Bristow does not believe that the new designs of the aircraft engineer for commercial aviation will be able to so increase the earning capacity of the machines that present losses in operation can be turned into profits. He says:

"The first item that has to be recognized is the impossibility of at present making anything but a financial loss from the operation of commercial aircraft, although on paper it can be shown with comparative ease that the conveyance of passengers and goods by air can be attended with the happiest financial results even without the assistance of a subsidy. It is so tempting to work out the cost of gasoline and oil for four trips, London to Paris, per

machine per day, deducted from gross receipts, calculated upon the assumption that machines are always full, and out of the handsome balance provide for maintenance and depreciation, and a dividend of 200 per cent per annum. In practice it works out differently. With the aid of the present subsidy schemes in Europe, some air transport companies may be showing a profit, but in analyzing the real position, it is necessary to omit the subsidy items from the accounts. It is clearly impossible to wipe out all aerial transport losses by improvements in thermal and aerodynamic efficiencies. . . . Improvements in equipment, organization and methods of operation are all most valuable, and must on no account be neglected, but the sum of them all will not be sufficient to turn the scale."

Col. Bristow believes that a very severe form of testing planes is necessary to show their stability before the public will lose its present sense of fear in aerial transport. He suggests that before a commercial airplane could receive a certificate of air worthiness it would have to make ten forced landings on a given route, immediately upon receiving wireless instruction from the ground, and that moment selected entirely by the wireless operator. Few might care to accompany the machine on such a test, but the majority of pilots in the course of a year will probably have to make forced landings under difficult conditions. He further believes that airdromes must be much more thoroughly equipped than at present, and declares, "there is not a single public airdrome properly equipped with apparatus by which loaded airplanes can be weighed, or the position of their center of gravity determined, and it is nothing short of remarkable that more accidents do not occur, as a result of ignorance as to these two vital factors."

Practical Suggestions

Col. Bristow has many other suggestions of a practical character that should be carried out before civil aviation will be as attractive to the public as it must be in order to insure patronage to make it a success. Here are some of the suggestions:

On each aerial route there should be a wireless operator who acts solely as a watcher and guide to the machines in the air. He should not be engaged in transmitting other messages, but engaged solely in serving the machines in transit.

At present on the London-Paris route the weather reports are often many hours late and unsatisfactory, with the result that on many occasions passengers have been landed in all sorts of out-of-the-way places.

Silencers should be fitted as their absence prevents the operator making full use of the wireless telephone, the engine noise adversely affects the safety of the machine in that it prevents the pilot hearing any unusual noises in his engine, and most passengers complain of deafness after a flight, and also of not being able to talk, except with greatest difficulty while on the route.

Aerial cabins are either too hot or too cold, and no serious endeavor has been made for ventilation. Traveling from London to Paris recently the temperature in the cabin was 32 deg. Fahr. for over two hours in addition to which there was a draft of about 500 ft. per minute. Frequently no passengers have food between breakfast and 4 o'clock in the afternoon when they make this trip.

The permissible 30 lb. of baggage carried free has been a great source of trouble. This is only a relatively small proportion of the baggage that passengers carry. In many cases it is impossible to take excess baggage on the plane, and when done it is a very expensive luxury. Baggage divided this way has given no end of trouble, and many times aerial passengers spend three or more days in the hotel waiting for their baggage to arrive. There is

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sometimes plenty of room in the fuselage for baggage, but the doorway is too small to permit of using the space.

Life assurance companies should be persuaded to allow ordinary flying under the terms of the standard life and accident policies. It is not likely that people who have paid premiums for years are going to travel by a route on which their policies are rendered null and void in the event of their death. It is a very bad advertisement for civil aviation that almost every life and accident policy in the country places a complete ban on flying. It will be a red-letter day in the history of commercial aviation when this restriction is removed.

Col. Bristow would have flying a part of the curriculum in every school in the country in order that the rising generation may be taught to regard air travel not as a romantic novelty, but as one of the sober facts of life. He would have the history of flying, the development of commercial aerial transport, and the engineering and scientific aspects of flight taught. He would use the movie as a factor in aerial education. Lastly he suggests an educational propaganda among industries.

Col. Bristow recommends a very big reduction in rates for aerial travel. The old price for a ticket from London to Paris was ten pounds sterling, and when this was reduced to eight the number of passengers increased very considerably. He believes the single fare will have to be reduced to four pounds sterling before the necessary increase in passenger traffic can be obtained.

A revised policy for research and experiment in connection with the problems associated with the development of civil aviation is needed. There is immediate need for machines of the latest types and a large number of engines.

Most important is an establishment for the adequate training of commercial pilots, which training must be much more comprehensive than that needed for pilots during the war.

Information of a valuable nature on the present and future state of commercial aviation was given at the Air Conference by Lord Gorell, Under-Secretary of State for Air.

The relationship between military and naval aviation, which may be designated service aviation for convenience, and civil aviation, was well established when he expressed the thought that service and civil aviation complement each other, and that the closest parallel is that of the relationship between the Mercantile Marine and the navy. The navy maintains peace and order on the seas; the mercantile marine transports passengers, goods and mail, and in case of need assists the activity of the navy. The parallel may be regarded as holding good in another respect: The development of the mercantile marine was by direct government action, and it did not depend on subsidies for its expansion, but rather on fundamentally sound commercial principles. Such, Lord Gorell believes, is the true view of civil aviation.

The one great essential for civil aviation is that of constant scientific research; in fact, research is the essential length between service and civil flying.

In commercial aviation the incorporation of the airship must not be overlooked. In this field the best hope of successful development lies in private enterprise conducting the service for profit, just as the mercantile marine has been developed on a business basis. Aerial transport has been hindered a little by what may be termed the exclusive enthusiasm of advocates of airplanes and airships respectively. It is a mistake to concentrate regard wholly upon one or the other; the functions of both, though rather different, are concerned with transport through the air, and the capabilities of each should supplement those of the other. The airship can be employed most economically over long distances, and the airplane most economically over distances which, though of considerable length, are yet much shorter. Lord Gorell reminded the Air Conference that a recent airship report stated that if airship service were maintained for a minimum period of inauguration of one year the establishment of the route from England to Egypt could be definitely begun and tentative flights made beyond Egypt in the direction of India and South Africa at an estimated cost of £540,000. If the service were to be maintained for a two-year period a regular monthly service to Egypt could be established, the definite extension to India begun, and demonstration flights carried out toward South Africa at an estimated cost of £1,839,000. . . . If it were decided to establish an Imperial Service on a definite basis, the construction of new airships, and of fully equipped permanent basis in South Africa and Australia would be necessitated. It is considered that this establishment could not be completed under five years and that estimated cost would be £8,000,000.

Lord Gorell gave a comprehensive survey of civil aviation in different countries.

Germany is fostering airship development by the means left at her disposal by the Peace Treaty. Her scientists are probing the constructional problems connected with large airships, and every effort is being made by financial and other assistance to maintain her technical staffs and air bases in existence. German commercial interests are negotiating with foreign countries with a view to the development of airships and airship services abroad. Plans are being discussed for an airplane service between Spain and Argentina.

France has decided to provide six airship stations, two in France and four in North Africa.

Italy is discussing plans for maintaining an airship service between Rome and Tripoli, Africa, first for mails and later for passengers.

In Italy aircraft is leased temporarily to private aviation companies for training purposes, and the budget for 1922 included grants to Swiss companies to assist them in purchasing modern airplanes. Aerial transport lines receive further subsidies based on the number of pilots they keep in training. An airdrome is to be established at Constance for international traffic with Germany.

Aviation in Holland

The 1922 budget of Holland includes 1,315,000 florins for civil aviation, of which 370,000 florins were set aside for subsidies for air transport companies. During the summer of 1921, 289 flights were carried out between Amsterdam and London, 278 between Rotterdam and Hamburg and 433 between Amsterdam and Paris. There were 1511 passengers, 30,856 kg. of various articles, and 1395 kg. of mails carried.

In Czecho-Slovakia the vote for civil aviation in 1922 was 9,080,000 kroner as compared with 6,850,000 kroner for 1921. One company will receive a subsidy of 6000 kroner in connection with the Paris-Prague air service.

The total civil aviation vote in France for 1921 was

184,500,000 francs, or 55,000,000 francs more than in 1920. Of this, 33,000,000 francs were allocated for subsidies and 25,500,000 francs for two rigid airships, airship bases and supplementary equipment. For 1922 the aerial budget is 152,000,000 francs, of which 46,000,000 is for subsidies.

In Canada the \$700,000 voted for 1921-1922 has been used for the survey of air routes, regulation of flying, acquisition and maintenance of civil air stations and work has been carried out for forest patrolling, fisheries protection, surveying, anti-smuggling operations, etc. The Air Board lends airships and airplanes to commercial companies free of charge under certain conditions. Between April and July, 1921, there were made 518 flights on civil government aircrafts, 73,000 miles being covered. No direct subsidies for commercial air services have been given.

Australia allocated £54,000 to be spread over three routes: Geraldton to Derby (Western Australia), 1195 miles—subsidy £25,500; Sidney to Adelaide, 795 miles—subsidy £17,500, and Sidney to Brisbane, 590 miles—subsidy £11,500. The saving in time to passengers traveling from Sidney to Brisbane and Adelaide is 18 and 14 hours respectively.

During part of the summer of 1921 an air transport service was maintained between Stockholm, Sweden, Reval and Riga. In all, 31 trips were made in each direction, and 17 passengers, 575 pounds of merchandise, and 1480 lb. of mail carried. The average time from Stockholm to Reval was 2¾ hours as compared with 24 hours by boat.

Belgium in 1921 voted 10,000,000 francs for civil aviation, of which 1,600,000 francs were for subsidies. The subsidies were equivalent to a 200 per cent addition to the receipts from passenger fares. There was a big increase in aerial traffic between Belgium and England during the summer of 1921, as compared with 1920. In the 5 months, May to August, inclusive, in 1920, only 49 passengers were carried in Belgian machines between Belgium and England, 38 journeys being made. During the same 5 months in 1921 there were 597 passengers carried and 339 journeys made.

Civil Aviation in France

There has been a very great development in civil aviation in France in the last few years due to its subsidies.

In 1919 there were only 3 companies operating on 3 routes, but in 1921 regular and frequent services, worked by 7 different companies, were in operation from Paris to London (3 services each way daily); Amsterdam via Brussels (once each way daily in addition to direct services 3 times a week to Amsterdam), Warsaw via Strassburg and Prague (once daily), and from Toulouse to Casablanca (four services each way weekly), Bordeaux to Toulouse and to Montpellier (once daily), from Montpellier to Nice (twice a week each way), from Bayonne to Santander (daily), and there was also a service from Paris to Le Havre to connect with transatlantic steamships, operated by the Compagnie des Messageries Aériennes, which is also responsible for the greater part of the journeys between Paris and London. The services between Paris, Prague and Warsaw are carried out by the Cie Franco-Roumaine de Navigation Aérienne, which is subsidized by the Czecho-Slovak Government as well as by the French, and also receives important privileges from the Roumanian and Polish governments. In a period of about 12 months ending last September the company's machines covered 156,520 miles and carried 500 passengers, 80 tons of goods and 300 mail bags. An extension of the service in the spring from Prague to Constantinople is proposed.

Arrangements have been made by the Government for civil pilots liable to mobilization to have opportunity for one hour's flying a month free of charge at any one of

"It is probably a fair statement that commercial aviation has up to the present time been little more than a full scale experiment with apparatus largely of a makeshift and temporary character. In spite of these limitations the results have been extremely interesting and valuable."

five training centers for reserve pilots, which are organized under the control of the Service de la Navigation Aérienne.

The following statistics illustrate the total work carried out by French civil aircraft from Jan. 1 to Sept. 30, 1921:

Number of flights.....	5,115
Number of machine-hours flown.....	14,100
Average duration of each flight.....	2 hr. 45 min.
Approximate machine mileage.....	1,145,500
Number of passengers carried.....	8,761
Weight of goods carried, in tons.....	126

The French air traffic between Paris and London showed a considerable increase last year. Between April and September the number of departures and arrivals of French machines to and from the Continent amounted to 1058, compared with 408 for the corresponding period in 1920, while the number of passengers carried in French machines was 3449, as against 312.

The development of aviation in French colonies must also be noticed. A mail service is operated in Syria three times a week, which covers the 75 miles between Aleppo and Alexandretta in 1 hour, whereas the only alternative means of transport—a combination of rail and steamer—occupies between 8 to 10 days.

A proposal is also on foot for linking up Paris, Marseilles and Algiers by an airship service, and to establish airplane services between Algiers and Biskra and between Algiers and Casablanca. For subsidizing these routes 1,000,000 francs was included in the Algerian budget for 1922.

In the United Kingdom the greatest activity in civil aviation was during the summer months. During August, 1921, 155 flights in British machines to the Continent carried 920 passengers. During the summer months—April-September inclusive, two daily services were operated between London and Paris, when 4006 passengers were carried. The British machines carried 500 more passengers than the French machines, but the French carried the greatest proportion of merchandise, 53 tons as compared with 11 tons in British machines. The British service showed a high efficiency as 93 per cent of the flights made during April-September were completed within 4 hours, as compared with 82 per cent being completed within 4 hours in 1920.

Accident Statistics

The number of accidents has been encouragingly small; for each flying accident during the 29 months from May, 1919, to September, 1921, the average number of machine-miles flown was 33,000; of the 142,241 passengers carried, 12 were killed and 17 injured. The rate for the six months ended Sept. 30, 1921, was less, and only one passenger was killed and one injured during that period.

During the 12 months ending Sept. 30, 1921, imports into the United Kingdom were carried by air to the value of £512,060 and the value of exports (including re-exports) was £278,131; the bulk of the goods were carried between this country and France, but the major portion of them on other than British machines.

Automotive Market in Argentina

Keen competition requires study of local problems. Service vitally important. The writer, engaged in selling in the Argentine, gives his opinion about choosing representatives and offers suggestions to American manufacturers as to method of procedure necessary for sales success.

THAT the American manufacturer of motor cars, trucks, accessories or tires may fully understand the market of Argentina, he must realize at the outset that Buenos Aires is the most difficult and intensely cultivated market for any kind of product, whether automotive, dry goods or perfume. As the South American seems to believe that New York is the center of the United States, so the citizens of other countries believe that in South America all things commercial center around Buenos Aires. Hence the manufacturer selling goods in South America concentrates on this city.

This concentration of effort brings the merchants of Europe and the United States into keen competition. Unheard of sacrifices as to terms and prices are sometimes made, and the Argentine is a close buyer, very experienced in dealing with merchants of other countries.

There is very little manufacturing done in Argentina. In some cases, however, local factories have attempted to imitate American products, such as lamps and small parts. The few repair shops that do exist are equipped, in many instances, with American machinery. There is one large manufacturer of storage batteries located at Buenos Aires, known as the *Fabrica Nacional de Acumuladores*, the product called "Nacional," of good quality and giving satisfactory service. This firm purchases many of its parts in the United States.

To sell motor cars in Argentina, one should know something of its geographical situation. It is a vast country with many good roads and several very large cities in the interior. There are three principal ports of entrance, Buenos Aires, the largest; Rosario, situated on the Parana River, capable of accommodating vessels of 18,000 tons and over, and where the banks of the river are so situated that ships unload on the land without the aid of wharves; and further south lies the port of Bahia Blanca.

Many hundreds of miles southward, in Patagonia, other ports are found, giving entrance to the sheep raising country and the great oil fields of Rivadavia. At the foot of South America lies the important port of Punta Arenas, which is open about six months out of the year. This port handles the sheep raising country, where motor trucks are greatly needed for the transportation of wool, as there are no rivers large enough for that purpose in that section of the country.

There are two important factors to be considered in conjunction with selling cars in the Argentine. They are:

- (1) To send out the right sort of man for the work,
- (2) To select the proper kind of representation without putting too much stress on credit reports.

American manufacturers are prone to forget that it costs many times more to travel and do business in

South America than it does in the United States. To be successful, a man must know the people and have some knowledge of Spanish, which he can pick up quickly if he keeps away from English-speaking people as much as possible. The manufacturer will find it advisable to send out an experienced man, for he will secure better results and be able to get in touch with influential people.

Too often manufacturers close contracts with foreigners on the strength of fine words and a large letter of credit. This type of person may even have letters of introduction from influential people and officials and give an initial order for ten or more cars.

It is better not to depend wholly on these favorable signs, but before closing a contract to spend \$50 on cables to ascertain whether the prospective dealer runs a repair shop; what standing he has in the community; whether he has ever refused a draft drawn on him by an American firm, without a cause which can be considered honest, or whether he has taken advantage of exchange conditions, as many have during the past year, and refused to accept shipments.

No manufacturer should give any firm an agency that is not willing to place an order for at least two of each model of cars. In instances where a factory makes but two models, the initial order should be for not less than six cars, and in every case 20 per cent of the purchase price should be spent for repair parts. Service must be given and it cannot be given unless the dealer is prepared to furnish repair parts.

It is a mistake to give an agency to any firm not equipped with a "taller" or repair shop. A firm in Buenos Aires, for instance, handling one of the leading American cars, once took the position that they did not wish to see the car after it left the salesroom. This firm was worth \$1,000,000, but it had no repair shop. To-day it is out of business, as might be expected. If service is not given, the resale is apt to be lost to a concern that does give service.

The vast size of Argentina has an important bearing upon the type and number of agencies a manufacturer will need to market his product most efficiently. There are over 8½ million people in the country. In the city of Buenos Aires there are 1,750,000. There are five cities outside of Buenos Aires with populations of over 60,000, and each an important point of distribution; Bahia Blanca, a seaport city of 348,000 inhabitants, located on the south shore; La Plata, thirty miles from Buenos Aires, where some of the largest packing plants are located. Many ships load freight and take on passengers here and it is a noted university city; Rosario has 222,600 people and is a shipping point for a vast province; Tucuman is the center of the sugar industry; Mendoza, while it has only 50,000 inhabitants, is the center of the wine country, very wealthy and at the foot-

hills of the Andes through which the Transandine road passes over the mountains into Chile. Sante Fe and Cordoba, a favorite summer resort in the foothills of the Andes, are both important cities.

An American motor car builder making a contract with a Buenos Aires dealer who wishes the entire Argentine as territory should so word the contract that the dealer will be obliged to place sub-dealers in the principal cities, that if this part of the contract is not carried out, the manufacturer will have the right to go after the business in the neglected provinces himself, giving the Buenos Aires dealer the commissions due him.

Advertising as an aid to Argentine dealers has been neglected by American manufacturers. Manufacturers must learn to give the same advertising aid that they do in their own country in order to develop business.

Successful advertising requires that the medium used be written in the language of the country. The biggest part of all cars entering the port of Buenos Aires are sent inland for distribution, and advertising matter must also go inland to bear results. The type of advertising used in the United States cannot be applied to local conditions in the Argentine.

Federal Income Tax Amortization

THE new Federal Income Tax Law provides for a reasonable deduction for the amortization of buildings, machinery, equipment or other facilities constructed, installed or acquired on or after April 6, 1917, for the production of articles contributing to the prosecution of the war against Germany.

A recent compilation of this law with relation to amortization has been made by Mr. T. W. Dinlocker, assistant comptroller, S. K. F. Industries, Inc., and the most important features of the law are well worth studying now, as claims cannot be filed later than March 15, 1922.

Mr. Dinlocker states that:

"Under the law, amortization is permitted in case buildings, machinery, equipment or other facilities were constructed, erected, installed or acquired on or after April 6, 1917, for the production of articles contributing to the prosecution of the war. Reference to the Revenue Act of 1918 makes it clear that the differentiation between those industries to which amortization shall or shall not apply is as between essentials and nonessentials. The fact that any industry was allowed to operate under priority is evidence sufficient of its essential character. It is not necessary that the product was sold to the Government, nor even to Government contractors, to bring the manufacturer of essentials within the rule."

"Under the regulations amortization is divided into two distinct classes, the first known as Class I, dealing entirely with buildings, machinery and equipment which have been already discarded or will be at a known date previous to March 3, 1924. The second, or Class II, deals with buildings, machinery and equipment which have and will undoubtedly continue to have a certain value in use to the taxpayer in his going business."

"Class I amortization is relatively simple to determine. This covers buildings, machinery and equipment that have been discarded or will be discarded at a known date. Class II, the more difficult of determination, covers property which still has and probably will continue to have a value in use in the going business, when the useful value is not to be taken at less than the salvage value. Salvage value was ruled to be the value ruling during the first part of 1919, but this value is abnormally high; later interpretation and application of the law and regulations has become more reasonable and liberal."

"In support of all amortization claims, it is necessary to submit a statement showing the calculation of amortization in the following form:

- A.—Description of property.
- B-1—Date of acquirement or date when construction, erection or installation was begun.
- B-2—Date on which construction, erection or installation was completed for operation.
- C.—Reference or Voucher Number.

TOTAL COST

- D-1—Expended prior to April 6, 1917.
- D-2—Total subsequent to April 6, 1917.
- D-3—Depreciation or losses sustained prior to Jan. 1, 1918.
- D-4—Depreciated cost on which amortization is based (D-2) less (D-3).

RESIDUAL VALUE

- E-1—Apportioned to period prior to April 6, 1917.

APPORTIONED TO PERIOD SUBSEQUENT TO APRIL 6, 1917

- E-2—Estimated value in use in going business.
- E-3—If property has been sold, amount received.
- E-4—If property has been discarded, estimated salvage value.

Amount to be amortized (D-4) less (E-2), (E-3) or (E-4)

Roads and Dollars

REPORTS which have reached the President's Conference on Unemployment since Jan. 1 indicate that highway construction in the various states will provide work for 200,000 men during 1922.

Under the provisions of the Federal Highway Act, 30 states have informed the office of Col. Arthur Woods, chairman of the Emergency Committee in Washington, that plans are under way to build 6261 miles of good roads.

This act was one of the recommendations of the conference as an emergency measure to provide jobs for the nation's unemployed. A fund of \$75,000,000 was created, to be apportioned among the states taking advantage of the act, each State to have its own allotment for road construction matched by a similar amount from the Federal Government.

Estimates by governors show that \$40,000 will be the average amount per mile expended. When the work is approved by Federal inspectors, the State will receive from the United States about \$20,000 per mile.

"The Federal Highway Act," said Colonel Woods, "ought to result in a large extension of good roads mileage throughout the country. At the same time it is helping to solve the unemployment problem until our various industries pass through the present crisis and take up the slack that puts every willing worker in the country back on the payroll. In addition, the taxpayer will benefit, as well as his unemployed neighbor, by the opening up of new districts and the improvement of existing highways."

Relationship of Bus Transportation to Electric Railways

Need for a better understanding as to the merits of each method of transportation is apparent. In this article is shown the attitude of the electric railway companies toward bus transportation as clearly evidenced in the recent semi-annual meeting of the American Electric Railway Association.

By Harlow Hyde

THE undercurrent if not the main theme of the semi-annual meeting of the American Electric Railway Association, held in Indianapolis recently, was to the effect that co-ordination of all trackless transportation is necessary, and that the co-ordinating must be planned and carried out by the electric railways and the interurban lines. The morning session was given over entirely to this discussion in papers presented by C. D. Emmons, president of the United Railways and Electric Company of Baltimore, Md.; E. B. Whitman, member of the Maryland Public Service Commission; Paul Shoup, president of the Pacific Electric Company of San Francisco, and Harry Reid, president of the Interstate Public Service Company (interurban) of Indianapolis. Three of these papers voiced the view that there must be co-ordination of street and highway electric transportation and of buses, jitneys and trucks, and that "urban and interurban transportation is a natural monopoly and that the public will best be served where the needs of a particular city or community are met by a united system."

Mr. Emmons, who had made a study of London bus transportation and of the transportation phases of other British cities, together with the tubes and trams, presented facts as well as conclusions which the truck and bus manufacturer, as well as their sales departments and organizations, might study to advantage. He shows that during the normal hours buses are very popular in London, carrying 30 per cent of the total. While the underground and inter-suburban railways carry 40 per cent, trams haul about 30 per cent of the total. The amount of trackage in cities in the British Isles is far below that found in American cities. One mile of track to every 6000 people represents the largest trackage of any of the British cities cited. He states that the trackage varies from one mile to every 1500 people to one for every 2500.

In another portion of his paper Mr. Emmons makes the statement that, "There is probably not a city in the United States that would not have a different layout and distribution if it were laid out anew to fit conditions as they now exist, resulting in much less mileage to operate and the ability to give better service to the car rider." In light of the street car companies' demands that they have the right to earn "6 per cent" dividends, and their constant fight to abolish jitneys and buses if they are not co-ordinated by the street car lines, this is enlightening. Electric railway revenue difficulties enter into almost every fight against buses, and have been one of the main sources of restriction in this growth.

Mr. Emmons' paper has this statement: "In many places these jitneys and even operators of buses of a

higher type of transportation than that given by the so-called jitneys themselves have been permitted to operate in such a piratical manner that they actually steal from the established transportation company—whose aim is to give all-round city service—sufficient to continue an existence, and at the same time to cause a starved condition of the transportation system." His final conclusion is that "in American cities a complete, comprehensive and satisfactory transportation system at a minimum cost can only be secured by means of control of all city transportation agencies in the hands of one management." His proposals, if adopted, would abolish jitneys and buses, unless the electric railway lines could control and operate them.

Even more in favor of this sort of control was Ezra B. Whitman, Public Service Commissioner of Maryland. He began with this statement: "It is probably not necessary for me to argue before you gentlemen that urban transportation is a natural monopoly, and that the public will be served best where the transportation needs of the particular city or community are met by a unified system." That this is not the only attitude of some electric systems toward buses may be gleaned from a later statement of fact that appeared in his address.

Speaking of the fight against the jitneys and the buses in Baltimore he said:

The street railway company, fighting fire with fire, or rather buses with buses, started a competing line on Charles Street, and when the independent line had been forced to retire from the field, sought permission to discontinue the service. This permission the commission refused to give, although according to the figures submitted by the company the line had been operated at a loss. It is evident from this that the bus or truck maker cannot consistently count upon the "co-ordination" of buses and other trackless transportation that the electric companies urge. In this case there was a deliberate attempt to blot out the bus lines.

That the truck maker can expect a similar antagonistic attitude from the interurbans can be gathered from the paper of Harry Reid of Indianapolis, president of the Interstate Public Service Company (interurban). His entire paper would be more than worth reading by every truck maker and sales department of commercial vehicles. Mr. Reid said: "Probably many of you know that I am opposed to these transportation agencies as competitors of the electric railway interurban, and that I feel they should be disposed of by legislation which would result in the regulation of their business by the

Public Service Commission or by some other agencies, on the same theory that two electric or two water companies are not allowed to operate in competition . . . believing that our interurban business, to be successful, must operate as a natural monopoly, the same as any other class of utility service." As interurban forerunners Mr. Reid thinks that trucks and buses may be of service in opening up new territory that may later be tapped by the interurban. He would have the interurban use the truck or bus extensions as feeders to see if there were sufficient business in the territory to warrant extension of the tracks. In the light of his paper it would seem that he considers that the whole State, or even larger territories, form the basis of "the natural monopoly" of the interurban lines. He would have no truck lines or buses as feeders or extensions unless the interurban felt like putting them in. Meantime the makers would await the pleasure of interurban company leisure.

A little study of local motor transportation history, regulation, taxation and licensing will show the truck

and motor vehicle maker that here at least the electric companies do not need the urging that was prominent at the meeting to the effect that all these electric companies and men get into politics. One of the officers of an Indiana interurban company (G. K. Jeffries, general superintendent of the Terre Haute, Indianapolis and Eastern Traction Company) has been for several years president of the Hoosier State Automobile Club. This club has taken a prominent part in motor vehicle legislation in the State, the club boasting of its success in getting the bills drawn up by it through the legislature. Among these bills is one that places the truck license fee near to the proposed Uniform Motor Vehicle Law fees, while the passenger car is assessed at about one-half of the rates that would be established by that fair rate. Another fact worth the truck makers' note is that Indiana has lagged behind to an almost unique degree in the making of hard-surface State roads. The gravel roads break down in the spring and right now trucks have to be kept off many of the main trunk lines.

Tractors on Southeastern Farms

A STUDY of the reports of 684 tractor owners in Alabama, Georgia, North Carolina, South Carolina and Tennessee which has just been completed by the Division of Agricultural Engineering, United States Department of Agriculture. The reports were made in March, 1921, and at that time 86 per cent of the number reporting believed that their machines would turn out to be profitable investments and 90 per cent stated that they intended to use them during the ensuing year.

It must be remembered, however, that most of the owners of these tractors were operating farms considerably larger than the average. Of the 684 farms, the average size was 290 acres, while according to the 1920 census of agriculture the average size of all farms in these States was only about 75 acres. Over 90 per cent of the farms reporting are more than 75 acres in size. There is no great difference between the crops raised on the farms where tractors are owned and on those where tractors are not owned.

The 2-plow tractor is evidently the size best suited to the needs of most of these farms. Seventy-six per cent of the 684 machines are of this size, and about 66 per cent of the men reporting now believe that this size is the best for their conditions.

All of the men whose reports were used in this study purchased their tractors between March, 1918, and September, 1920. The average first cost of the machines was \$1,050, and the average of the owners' estimates of their useful life was 7.6 years. On this basis the annual depreciation charge is \$138 per year.

Each owner was asked the number of total days' work done per year with his tractor, and the average of the replies was 53 days. The 2-plow tractors were used an average of 52 days per year and 3-plow tractors 56 days.

About 80 per cent of these men used disk plows with their tractors. The average acres covered per day with the 2- and 3-bottom disk and moldboard plows drawn by these tractors is as follows:

2-plow disk	4.7 acres	2-plow moldboard . . .	5.3 acres
3-plow disk	6.5 acres	3-plow moldboard . . .	7.3 acres

Over 90 per cent of these men stated that the quality of the plowing done with their tractors was better than that which they formerly did with horses or mules. The tractors drawing disk plows used on an average about 3½ gallons of fuel per acre for plowing, and those drawing moldboard plows about 3 gallons per acre. This difference

between the fuel required when using disk and moldboard plows is due largely to the fact that the disk plows are narrower than the moldboard plows, and the acreage covered per day is correspondingly less.

The average cost (including charges for depreciation, interest, repairs, fuel and oil) per acre of using the 2-plow tractors for plowing in 1920 was \$2.07 when using gasoline and \$1.73 when using kerosene. For the 3-plow tractors it was \$1.90 when using gasoline and \$1.59 when using kerosene. These costs are based on 31-cent gasoline, 20-cent kerosene and 85-cent lubricating oil, the average prices which these farmers paid during 1920. The repair costs were computed on the basis of an annual repair charge of 4 per cent of the first cost of the machines and interest charged at 8 per cent on the average investment.

On account of the smaller acreage covered per day, and the greater amount of fuel used per acre, the cost of plowing with the disk plows was somewhat greater than was the cost when using moldboard plows.

Each farmer was asked how many days of man labor his tractor saved annually and the average of the replies was 66 days. The average of the replies of the owners of the 2-plow tractors was 63 days and of the 3-plow machines 78 days.

Nearly 50 per cent of the men reporting have increased the size of their farms since purchasing their tractors by an average of about 50 acres—from about 210 to 260 acres. At the same time they have decreased their workstock from an average of 6.7 head to 5.1 head. They kept an average of one head of workstock for each 31 acres before they purchased their tractors, and were keeping one head for every 50 acres at the time they reported.

The men who did not increase the size of their farms reduced their workstock from an average of 8.8 head to 7.4 head after the purchase of their tractors. Nearly half of the men, however, who were still farming the same acreage had made no reduction in their workstock.

A comparison of the reports of the men who were satisfied with their tractors with those who were dissatisfied showed that in some cases the failure to take advantage of the opportunity offered by the tractors to increase the acreage and reduce the workstock was probably responsible for the dissatisfaction; in other cases the poor service rendered by the tractor was responsible, and experience has shown nearly one-half of the dissatisfied owners that their tractors are not the proper size for their farms.



Front Wheel Driving

Editor, AUTOMOTIVE INDUSTRIES:

I differ in several respects with the "Front Wheel Drive" editorial in the Sept. 15 issue of the AUTOMOTIVE INDUSTRIES.

It is true that there has been renewed activity in connection with front wheel drive automobiles and commercial cars, and it is well that this is so, because the advantages claimed for this particular drive in a good many instances make it superior to the rear wheel drive now in almost universal use.

In the second paragraph of the editorial the possibility of using a low-hung platform and body is treated in such a way as to make it appear that this is the most important advantage gained by employing front drive, whether it be through the bent rear axle or by some other means. The uses cited give but little idea of the possibilities in any and all industries. So far as the possibilities of a low-hung body are concerned, this can be realized on the rear driven car almost as well as on the front driven car, but possibly not quite to the extent as with front drive.

In regard to the disadvantage of a low-hung body in that it brings the passenger closer to the dust of the road, it may be said that the 6 or 8 in. that the body could possibly be lowered as compared with the body of a rear driven car is unimportant. I believe that passenger cars, particularly, are low-hung enough in present constructions so that a front drive automobile could be built almost identical with a rear driven car without interfering with the style of bodies used at the present time, hence dust as well as road conditions would remain the same for both.

Also, in order that the body may be low-hung, it is not at all necessary to crank the rear axle, as the body accommodations are very similar to those of the rear driven car, though possibly 4 in. or 6 in. at the most can be gained by lowering the body without greatly interfering with the seating arrangements. Neither will the front seat suffer; its capacity and comfort are just as great as in the present-day automobile. The rear seat can be made much more comfortable. Both seats can be made deeper and provided with softer cushions, as is the case with present-day cars.

It is also plain that the location of the driving axle under the front end greatly favors the spring suspension. There will be less jerking when the car starts and stops. On the present-day car or truck, whether the drive is of the Hotchkiss type or whether torque tubes and arms are used, the tendency of a car is to lift or draw, and unless cushioning is excellent and the back of the rear seat is well upholstered it may become rather uncomfortable after a certain length of time on the road. This, however, is not true of the front driven car for reasons explained above. The spring need be only for suspension and not for driving; consequently, the action can be much softer.

As regards the efficiency of transmission, it can easily be shown to be greater in the front drive automobile

than in the rear driven one. Reductions are different, the number of gears in mesh are different, the connections are less in number, moving parts operate at less disadvantage and bearing applications can be simplified. Two bearings necessary when propeller shafts are used can be eliminated. It has been demonstrated that it is much easier to pull a vehicle around a corner than to push it. On a front wheel drive automobile the power-driven wheels are turned in the direction one chooses to drive. In a rear driven car turning is accomplished by swinging the front wheels around. They will then encounter increased resistance in the direction they have been traveling and proceed in the direction of least resistance. At the same time the rear axle, while tending to drive straight, differentiates between the speed of the inner and outer wheel, being forced to draw a larger circle with one wheel than with another.

On a front wheel drive the exact opposite occurs, assuming that the front axle of a front drive automobile is the same as the rear axle of a rear driven car. The power is transmitted through the bevel gears and divided between the two wheels by means of the axle shafts. It is true that the inner wheel will describe a smaller circle than the outer one; nevertheless, friction between ground and tire is not used to steer the vehicle, for the differential itself takes care of the speed variation around a curve and drives to wheels accordingly, instead of forcing them to make different speeds, due to the fact that the front wheels have been set at an angle, which necessitates deviation from a straight line.

It is not necessary to dwell much upon the natural tendencies of a front wheel drive to get out of depressions and raise itself over obstacles. While a rear driven car is forced to go into holes and out of holes, the front wheels are pushed against the far wall of the depressions instead of tending to climb over them.

Regarding the universal joint connections under pivot pins of the steering axle of a front drive automobile, it is only necessary that engineers provide mechanism of some kind which will take care of the differential motion of a joint at different angles and that angular speed variations, if not entirely eliminated, at least be reduced to a minimum. Also, it is up to the engineers to see that propeller shafts or universal joints are made in such size, of such quality and of such dimensions that they will withstand all the necessary punishment given them in service on a front drive car.

The author appreciates the difficulty of finding room for both the engine and the transmission in the limited space above the front axle or under the hood. However, the rear driven car with its body, hood, dash, fenders and with its entire outward appearance is not necessarily the ultimate automobile. New ideas and designs that upset old-established standards are coming through every day, and it is not necessarily true that the hood, body, dash, seats and fenders of an automobile must be as they are made to-day and cannot be changed to accommodate possibilities that are offered by a newer construction. If there is no space above the front axle, space can be made behind it. If present-day hoods are

not long enough, they can be made longer, and some day bodies may be more beautiful, more useful and more desirable than present-day bodies. In other words, the complete outward appearance of the car may undergo change if this is necessary to admit of a better mechanical construction. We have to-day ahead of us a period of improvement in which we shall see many new things develop and become successful. We should hesitate to attempt to wipe off possibilities of a construction that has never been given the opportunity to prove itself, but which construction is bound to receive attention from many quarters in the automotive industries.

O. E. SZEKELY.

Tractor Wheel Cleats

Editor, AUTOMOTIVE INDUSTRIES:

I notice that with the exception of Fordson and Allis-Chalmers, practically all the tractor engine wheels have the cleats slant with the inner edge forward, that is the end of the cleats next to the machine touches the ground first, while with the Fordson the outer end is forward and touches the ground first.

I wish to know if there is any special reason for this arrangement. It would seem that, taking into consideration the sidewise thrust due to the angle of cleat, the wheels should crowd together instead of spreading them apart as it would be with the Fordson. For instance, on sidling places on the down hill wheel the cleats should be arranged so the thrust would be up hill and prevent the tractor from slipping down hill.

I am interested in a four wheel drive tractor development in which this thrust due to angle of cleats is a feature and would like to have any data you can furnish along this line. Is there a treatise on cleats and their action under various conditions that you could refer me to?

J. N. P.

When the cleat is so slanted that the inner end touches the ground first there is a tendency for the wheels to be forced together on the ground by the reaction between the ground and the clear, as the torque impressed upon the driving wheel tends to cause that wheel to slip. Of course, thrust washers can be provided on the outside of the wheel hub or on the inside of the wheel hub, and it would therefore seem to make little difference whether the cleats were applied one way or the other. However, since the weight supported by the driving wheels has a tendency to make them spread at the bottom, it would probably be preferable to so arrange the cleats that the reaction of the ground on

the cleats forces the wheels together, as in that case the two effects would partly neutralize each other.

On side hills, if it is desired to overcome the tendency of the wheels to slide down the hill, it is necessary to have the cleats on all wheels turned so that the uphill side of the cleat meets the ground first.

So far as we know there has been no treatise published on the subject of cleats for tractor wheels.—EDITOR.

Paint Standards Needed

Editor, AUTOMOTIVE INDUSTRIES:

It has often occurred to me that the S.A.E. should take steps toward standardizing automobile painting materials and operations seem to point to this as a logical solution of the factory's problems. By this I do not mean that the different materials should be standardized by formulæ or chemical properties, but rather by their physical properties.

To illustrate: the three important properties of a primer are—penetration, drying rate and elasticity of the dried film; of a filling and surfacing material—body, drying rate and texture of rubbing varnishes—drying rate, working qualities and hardness of the dried film; and of finishing varnishes—drying rate, working and flowing qualities and elasticity of the dried film. From all of which you can see that simple tests will reveal what materials are best adapted for certain purposes without any concern as to the chemical make-up of the material—by that I mean an exact knowledge of just how it was made. This would be the first step to take in order to set the house in order. With this done every factory, job shop and painter would have reliable S.A.E. ratings upon which they could depend.

With such information at hand a number of standard jobs could be laid out and their durability accurately determined. The combination of operations will vary, of course, just as other production methods vary, but maximum and minimum durability could be determined, and this alone would serve a very useful purpose.

With such data available automobile factories could test their paints just as they are now testing their steels, etc., and definite data could be furnished the paint departments, that would do away with a lot of the unsatisfactory work that reaches the dealer and has to be done over. This would automatically cause the paint makers to put their houses in order and would react for the good of the entire trade.

CHICAGO COLLEGE OF AUTO PAINTING,

G. K. Franklin.

Review of Recent Publications

A BOOK entitled "Service Station Management," by Charles L. Jones, has just been published by D. Van Nostrand Company.

In the words of the author, the book was written with three definite ideas in mind, as follows:

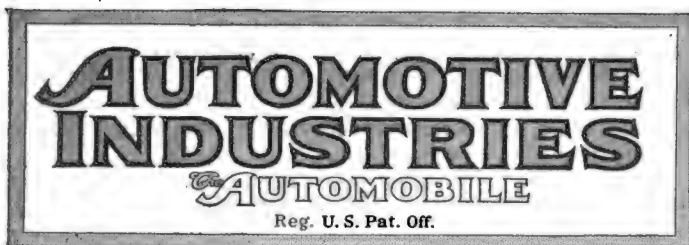
1. To assist the man just entering the automobile field.
2. To assist automobile dealers and service stations.
3. To serve as a guide to the chief clerk, superintendent, service manager, shop foreman and stock man.

To those who are studying methods of labor charges, Mr. Jones's remark on Flat Rate will be of interest. He says: "Flat rate charges, if computed on the proper basis, are the most satisfactory to dealers, and at the same time a protection to customers."

While the book applies directly to Ford service stations, there are many things dealing with merchandising service, such as management, layouts and systems, which

will be found of value to all who are making a study of the problem of service.

A NEW edition of the Export Trade Directory, compiled by B. Olney Hough, editor of the American Exporter, has just come off the press of the Johnston Export Publishing Co. This large volume, as its name implies, is a trade directory of firms engaged in the export and import trade. Information concerning the company, its foreign connections, the lines it handles and in many instances credit ratings are given, listing nearly 2500 concerns. Other departments give the branch houses in the United States of foreign firms, bankers engaged in foreign transactions, freight forwarders, steamship lines, marine insurance companies and brokers, export packing and trucking companies, foreign consuls in the United States and American consuls abroad.



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Sales Information

FROM the standpoint of good business management, much valuable material is neglected when the reason for the loss of a sale to a direct competitor is not secured and properly recorded. The immediate object of every retailer is to get the maximum number of sales possible in his territory and to do this he must understand the reasons for his failures as well as his successes. Ofttimes more can be learned from the former than from the latter.

Material of this nature must originate with the salesman and pass through the retailer to the distributor and ultimately to the manufacturer. In this way each unit of the selling organization may secure the specific information applicable to it. While this material may seem to deal strictly with the retail selling problem, it is nevertheless of importance to the manufacturer for three reasons, as follows: It would

1. Furnish a consensus of opinion on the product itself.

2. Tend to build up a strong, understanding selling organization.

3. Throw some light on the used car situation.

The average automobile salesman loses all interest as soon as the sale goes against him and is closed by a competitor. He makes no effort to learn why the sale went against him, believing that he learned the reasons while fighting for it. But this is not quite true, because oftentimes the purchaser is not willing to express himself freely until the sale is made.

The desire to know why a sale is lost can be fostered by the factory and if properly done should yield much information of value.

Hot and Cold

A LITTLE gathering was held the other night by representatives of the automotive industry to impress upon certain editorial molders of public opinion the great utility of the motor vehicle, its transportation efficiency, and its usefulness in the business and personal life of the nation. The passing of the "pleasure car" idea, the true utility function of the passenger car, and the utterly unjust nature of much of the taxation and proposed taxation directed against the motor vehicle were truthfully and ably presented

"All was quiet along the Potomac" until one journalist accepted the invitation to discussion and said something like this:

"Whatever general public opinion prevails in regarding the automobile as a pleasure or luxury vehicle is due chiefly to the car manufacturers themselves. We editors can never hope to mold public opinion to see the utility and transportation value of the automobile, so long as the manufacturers continue to contradict the editorial pages in almost every line of advertising copy which they write. Nearly every car advertisement stresses the luxury phases of the vehicle; the advertisements appear largely in those mediums which appeal to the luxury or amusement phases of life. The whole atmosphere that is thrown around 95 per cent of car advertising is that of pleasure, amusement, luxury, etc. Writers can not be expected to put over this new psychology of utility when those making the car forcibly and continually contradict them on the advertising pages of their publications."

The thought expressed is by no means a new one, but it is worth repeating. Its truth is not realized, apparently, in many parts of the industry. As the car market becomes more and more a replacement market, the proportion of "car-wise" buyers increases. The automobile serves a real utility function in modern life; its numbers grow because the vehicle serves a transportation need. Utility is the basis of its success.

Intelligent utility advertising is good merchandising; it is good business; it is fundamentally sound. And that is the reason for the emphasis upon the utility phase of the automobile. That phase should be emphasized because it is basic. The statement that the automobile is primarily a utility vehicle is

true and, by the same token, it is true that a large proportion of cars used are bought and used for utility or semi-utility purposes. This fact should be completely recognized.

Comparing the average car advertisement with the statements made before Congressional tax committees, it would seem that there was some difference between the facts and the statements. There is not.

Thinking Rightly

ONCE in a while some really constructive thought shines out from the mass of publicity and promotion material that reaches us daily. We received one of these gleams the other day in a bit of promotion material from the S. A. E. It was all interesting, but one paragraph is so pertinent to the solution of most of the problems confronting the automotive industry to-day that it is worth special attention.

"We must think rightly before we can act rightly. It has been observed that it is far easier to confuse human reason than the laws of gravity. The problems before us are bigger than any one man's head.

"It has been enunciated that at the root of our refusal to think things out in advance, to arrange concisely the forces adequate to attain a clearly conceived end is a sort of half belief and half feeling that it does not pay to think things out. Moreover, thinking is hard work, not to speak of formulating and executing sound plans for carrying out those things which proper study indicates should be carried out."

The longest way 'round is often the shortest way there. Actions based upon fundamentally correct reasoning are certain to bring success. Thorough analysis and thoughtful experimentation are essential to the proper solution of the marketing, engineering and production problems of the industry.

The Best Battery Location

IN what part of a passenger car chassis should the storage battery be located? A satisfactory compartment is usually provided in the modern chassis, but it is not always so placed as to be easily reached by the person who must fill the battery, and it is frequently difficult to remove the battery for repairs or recharging. Perhaps the most usual location is under the floor boards of the driver's compartment and near the right side of the frame of the car. This location avoids interference, in the case of left drive cars, with the clutch and brake control rods, but is apt to be too close to the exhaust pipe to prevent rapid evaporation of water in the electrolyte unless some heat insulation is employed. Furthermore, it may interfere with the controls in the case of right-hand drive, which is often required on cars intended for export, and it involves raising the floor boards or a section of them when access to the battery is required, and this is apt to be a dirty and somewhat inconvenient operation which is postponed or often neglected by the user, who might be inclined to fill the battery more often if it were more accessible.

From the manufacturer's standpoint it is desirable

to so place the battery compartment that it is easily reached regardless of the type of body furnished, since varying the location involves certain complications which are undesirable in quantity production. The life of the battery is increased by a location which minimizes the amount of jarring and vibration which the battery receives. Weight distribution is another element sometimes considered.

A battery placed under the driver's seat can often be made quite accessible, but this location also has some disadvantages, as, indeed, have nearly all locations in common use. The problem is somewhat different in the case of different types of bodies and different sizes of chassis, but there probably are one or two "best possible" arrangements which can be used in nearly all cases. The Forum of AUTOMOTIVE INDUSTRIES is open to engineers and others who have pertinent views to express in this regard.

Efficient Handling of Parts

WE have heard recently a great deal of discussion regarding the wastes of industry. It would, in many cases, be a revelation to go through automobile retailers' stock rooms. Here, unknown to the manufacturer and even to the retailer himself, exists a vast amount of inefficiency and resultant loss.

The underlying reason for this inefficient handling of parts is the lack of an appreciation of its importance. We doubt if a proper incentive is given for men to become experts in this field, with the result that the ambitious man who looks to the future enters the fields of production or selling at the first opportunity.

It may not seem necessary to the manufacturer to oversee the handling of parts as he would the selling organization, but such an action would be distinctly to his advantage as well as to that of the retailer. Some of the benefits to be derived from this procedure if properly conducted would be as follows. It would:

1. Enable the retailer to avoid tying up capital by stocking a minimum of parts.
2. Facilitate dealing with customers through accurate records.
3. Avoid tying up customers' cars through lack of replacement parts.
4. Facilitate the taking of inventories with proper writing off at frequent intervals.
5. Enable the retailer to determine his profit or loss on this part of his business.

It is not meant that there should be any heavy hand resting on the retailer, for it is desirable to give the greatest amount of freedom possible to the individual. What should be given is co-operation, and more specifically any analysis work on the proper method of handling parts which the factory is able to furnish. Assistance should be lent in establishing a system which would be applicable to the particular size of plant under discussion; a system which would operate in harmony with the factory.

Retailers who have this co-operation extended to them cannot help but be better representatives, and the result will have a far-reaching effect on the success of the selling organization.

Washington Sees New \$348 "Star"

Will Be in Quantity Production by June

Durant Responsibility Ends With Completed Car—Separate Distributing Company

NEW YORK, March 9—The new low-priced car, to compete with Ford, which will be manufactured on contract by Durant Motors, Inc., will be in quantity production by June 1, it was announced to-day. It will be turned out temporarily at the Long Island City plant of Durant Motors of New York, and the permanent factory site has not been determined. The first showing of the car, which will be called the Star, was given to-day in the salesroom of Harper Brothers on Connecticut Avenue in Washington.

The distribution, sale and servicing of the car in the United States and its possessions will be in the hands of the Star Motor Car Co., which will be independently operated and financed. Details regarding the stockholders in this company are not yet available. While it is understood to have been the original intention that parts companies which supplied units for the new car would be given an opportunity to take stock, it now is stated positively that these interests will not be connected in a financial way either with its production or distribution.

Among those who accompanied W. C. Durant to Washington for the unveiling were R. W. Judson, president of the Continental Motors Corp.; A.

R. Demory, president of the Timken-Detroit Axle Co.; C. B. Hayes, president of the Hayes Wheel Co., and Harry T. Dunn, president of the Fisk Rubber Co. Others in the party were F. W. Warner, former general manager of the Oakland Motor Car Co. and several executives of the Durant companies.

The responsibility of Durant Motors for the new line will end when the completed vehicles are turned out of the factory. No steps have been taken as yet towards the formation of a distributing organization, but it is understood that no exclusive territory rights will be given for the sale of the car. The sales policy will be practically identical with that established by Ford.

Detailed specifications have not been made public. The car will be powered with a Red Seal Continental engine, and it will have a conventional automobile chassis plus the Durant tubular backbone. The Hotchkiss drive is through semi-elliptic springs and the propeller shaft has Spicer universals. The transmission will provide three speeds forward and reverse.

Timken axles will be used and Timken bearings front and rear. Internal and external brakes operate on the rear wheels. The gasoline tank will be located on the rear, and the Stewart vacuum tank system will be used.

There will be a one-man top with a sliding windshield. A disk clutch will be used. The wheelbase will be slightly longer than that used by Ford.

Standard parts of high grade will be used throughout and the car will have the accessibility of the Durant models, which, it is claimed, will make service easy and not expensive.

Much remains to be told of the plans for the manufacture and sale of the car, (Continued on page 590)

Output in February Gains Over January

Schedules of Car and Truck Manufacturers Increased During Present Month

By JAMES DALTON

NEW YORK, March 7—With the coming of March, production schedules of most passenger car and truck manufacturing companies have been materially increased. While accurate figures for the aggregate February output are not yet available, it was considerably larger than for January. Total production of cars and trucks the first month of the year was 90,486 as compared with 78,995 for December. Eliminating Ford, the gain for January was 40 per cent on passenger cars and 38 per cent on trucks. The increase was largely in the lower price classes.

Parts Business Increases

Business in steadily increasing volume is coming to the parts and accessory manufacturers as the vehicle makers give unexpectedly early releases on materials to take care of expanding business. Sales in January exceeded January of last year by approximately 200 per cent. It is probable the excess for February was fully as large compared with the same month last year.

Manufacturers, especially in the Detroit district, are professing enthusiasm over the outlook, and the same is true of dealers in all parts of the country. Wherever shows have been held the attendance has been record-breaking, evidencing the interest of the public in motor cars. Dealers have booked many live prospects, and the actual sales at retail have been far ahead of last year.

Prices on passenger cars apparently have been stabilized for some time to come. Most manufacturers have brought their selling prices as low as they can go until further cuts can be made in production costs. There is no immediate prospect of lower material prices. Revival of demand in the truck field is leading to price recessions by makers who have not made reductions recently and some sharp cuts have been made.

(Continued on page 591)



"Star," which will compete with Ford in price

Templar Syndicate Will Handle Claims

**Company Owes Merchandise
Creditors \$1,000,000—To Ar-
range Three-Year Extension**

CLEVELAND, March 6—M. F. Bramley, president of the Templar Motors Co., announced at the annual meeting of the corporation that a syndicate is being formed to settle the claims for merchandise which creditors have against the company to the sum of \$1,000,000.

Members of the syndicate are: Bramley, W. M. Pattison and J. C. Brooks. This syndicate is to arrange for the carrying of the claims for three years.

Bramley was re-elected president and general manager; W. M. Pattison, vice-president; D. C. Reed, secretary and treasurer; John Orgil, counsel, and W. O. Cooper, director.

The annual report showed there was an operating loss of \$250,000 for the year ending Dec. 31, last, while the inventory was depreciated \$750,000. Car sales last year were 732. The company is still working off an inventory, and business has picked up in the last two months.

Six hundred stockholders attended the meeting, and at the close of business adopted a resolution of confidence in the management.

Peed Becomes Overland Assistant Sales Manager

TOLEDO, March 6—L. G. Peed, for more than a year manager of the Willys-Overland branch here, has been named assistant sales manager of Willys-Overland, Inc. R. L. Butler, zone supervisor for Iowa, Nebraska and Missouri, will succeed Peed at the local branch. W. O. Kiracofe, formerly sales manager of the Banting Manufacturing Co. here, has been named retail sales manager of the branch, to succeed L. J. McCracken, who will have charge of the Pacific coast territory for Willys-Overland.

Peed formerly was with the New York branch of Willys-Overland. He has been a prolific originator of sales and advertising ideas, many plans which he worked out for the branches with which he was connected having been taken up by the factory organization and put into effect throughout the country.

From Factory to Owner New Monroe Selling Plan

INDIANAPOLIS, March 4—An advertisement published in one of the local newspapers to-day by the Monroe Automobile Co. tells of a new plan of selling the Monroe direct from factory to owner. The new price of \$875, which is a reduction of \$420, is also announced.

The announcement is judged to be the forerunner of the reorganization promised at the time that a local bank, which had been the principal creditor, bought

the factory and assets from the receiver. It is understood that the detailed reorganization plan will be announced some time next week.

One sentence from the advertisement reads: "Briefly, the plan means the elimination of the distributor and dealer with their commissions and sales expense added to the cost of the car."

Hitchcock Takes Sweet's Place on Bearings' Board

NEW YORK, March 7—William M. Sweet has resigned as a director of the Bearings Service Co. and will be succeeded by A. C. Hitchcock, sales manager of the New Departure Mfg. Co., one of the concerns for which the Bearings company acts as a service department. Sweet's duties with the Klaxon company require all his time. William A. Brooks also has resigned as secretary of the Bearings company and has been succeeded by W. J. St. Onge, sales manager of the company.

Directors of the Bearings Service Co. have appointed an executive body which will be an operating committee. It will meet at the general offices in Detroit four times each year. Alfred K. Hebner, president of the company, will be chairman.

Court Limits Information to Be Given Trade Commission

WASHINGTON, March 7—Under the permanent injunction issued by Judge Bailey in the Supreme Court of the District of Columbia to-day, the Federal Trade Commission will be restrained from compelling various industries to submit monthly reports to the Commission of their costs of production and other intimate details of their business.

Conferences were held with various manufacturers several months ago in this connection, but the meetings adjourned pending the legal decision. Judge Bailey held that manufacturing is not commerce and that the Federal Trade Commission was trying to interfere with commerce.

The case at issue is known as the Claire Furnace Co. case involving twenty-two producers of iron and steel and coke.

Glass Leaves New Britain Machine Tractor Division

NEW BRITAIN, CONN., March 4—Edgar T. Glass, for the last several years sales manager of the tractor division of the New Britain Machine Co., has resigned to take up other work.

No successor has been appointed, but one of the company's officials states that he does not understand it is the purpose of the corporation to abandon the manufacture of tractors permanently. Tractor making was discontinued by the company at the time the industrial depression became pronounced.

Glass came to the New Britain company from the Stanley Works, where he had been associated with the sales force.

Smith Republic Head as Willys Successor

**Complete Reorganization of Truck
Company—Change in Stock
Control Is Forecast**

NEW YORK, March 6—Complete reorganization of the Republic Motor Truck Co., Inc., has followed the resignation of John N. Willys as president and the election of Frank E. Smith as his successor, which was announced in AUTOMOTIVE INDUSTRIES last week. Other resignations included those of H. I. Shepherd as treasurer and Walter P. Chrysler and James E. Kepperley as directors. Shepherd will continue temporarily as a director, as will W. J. Baxter and E. C. King.

New directors elected to fill the vacancies were: O. W. Hayes, vice-president in charge of engineering, purchasing and production; H. D. Minich, vice-president in charge of finance and accounting, and Charles G. Rhodes, secretary.

Offices Moved to Alma

It is understood that there has not been, up to this time, any change in the stock control of the company, which has been held jointly by Willys, Baxter and Burt, but this is forecast by a statement of the company that "these changes bring back to the West control which was transferred to New York at the time Mr. Willys and his associates purchased the stock of the company."

The executive offices of the company have been removed to Alma, Mich., where the plant is located. Shepherd will become vice-president of the Guardian Savings & Trust Co. of Cleveland.

Michigan and Illinois bankers now are taking an important part in the affairs of the Republic. As soon as the banks can obtain control of all the notes on which the company defaulted, the new money necessary for working capital will be provided. The company now has current assets of \$4,600,000, after taking a loss of \$1,000,000 on its inventory. While truck sales were light last year, the company made a large profit on parts replacement business. With the improvement in the truck market and with the readjustment of finances, it is confidently expected that the company will be able to move ahead on a substantial basis.

Branch Houses Established

To promote service and a comprehensive sales plan, the company has established or is establishing branch houses at Detroit, Buffalo, Albany, Boston, New York, Newark, Philadelphia, Baltimore, Atlanta, Charlotte, Pittsburgh, Kansas City, St. Louis, Chicago and San Francisco. It is proposed to establish additional branches within the next few months. New dealers are being added at the rate of approximately 500 a month.

It is understood that one of the specialties hereafter will be the building of motor bus chassis.

Detroit Factories Increase Schedules

Growing Cheerfulness in Evidence at Plants—February Ex- ceeded Anticipations

DETROIT, March 3—Production in Detroit factories for February was notable for the number of companies which materially increased their manufacturing schedules.

Production continued on a four-day week basis. There is a constantly growing feeling of cheerfulness in every factory. Production will be largely increased in March, notwithstanding that February ran far ahead of anticipations.

Dodge, Maxwell, Studebaker, Cadillac and Hupp are the factories already near maximum production. Dodge has been running along at about 600 daily; Maxwell, 200; Studebaker, 400, and Cadillac, 100. Ford has as yet failed to get into full swing on cars, but is making a record breaking number of tractors at River Rouge, schedules now approximating 200 daily.

Hudson-Essex to Triple Output

Hudson and Essex have practically tripled their parts and material releases for March, and President Roy D. Chapin said it would triple production of March of last year. Lincoln Motors will increase its production to a 30-daily basis in March. Increases will also be made by Wills, Roamer and Handley-Knight. Rickenbacker, which shipped 250 in February, will go on a 20 daily schedule in March.

Orders are reported ahead to summer in the General Motors divisions. Buick is preparing to go on full production. Olds has laid down a schedule which will approximate 70 daily in March. Oakland will build better than 100 daily. Chevrolet has laid down a schedule which calls for 50,000 production by July.

Durant Motors has been operating during February at the Lansing plant on a schedule of 40 daily and expects to reach 100 daily by April 1. The company was handicapped by non-delivery of closed bodies in February. Five hundred closed types will be built in March.

Reo Looks for Good Month

Reo has been operating steadily and looks for heavy production in March with dealer stocks of cars and speed wagons undergoing rapid depletion. Dort has laid down a schedule of 50 daily, which will be increased as rapidly as possible. Orders are reported to run ahead to early summer.

Paige has been rounding into production slowly during February and will get going firmly on its Paige and Jewett schedules in March. Earl Motors has been building 20 daily in February and will increase this to 30 in March. Columbia Motors is speeding up things at the factory in anticipation of production

RESERVE BOARD FINDS OUTLOOK IS BRIGHTER

WASHINGTON, March 3—Commenting on financial and economic conditions for the first two months of 1922, the Federal Reserve Board states that bankers generally believe the recent advances in the value of agricultural products has tended to create conditions materially facilitating both the liquidation of loans at banks and the rapidity of movement of farm products to their markets. These changes give promise that farmers soon will be in the market for motor vehicles as their inability to market their products at reasonable prices has been the chief deterrent.

Reports from the various Federal Reserve districts show that the improvement in conditions in several basic industries has furnished a more hopeful prospect for trade.

in April on its new \$985 line. March production will be solely of the former line.

Liberty is all ready to enter upon a heavy manufacturing schedule. Saxon is running along at 5 a day pending the determination of new manufacturing policies.

Kelly-Springfield Adds to Its Force at Factory

SPRINGFIELD, OHIO, March 7—There is a marked improvement in general business among the motor truck and automobile manufacturers here. General Manager E. O. McDonnell of the Kelly-Springfield Motor Truck Co. states that there is a steady improvement in the motor truck business and that the company has recently added a number of men to its force. There has been special activity in the engineering department. The outlook is considered most favorable.

The local works of the International Harvester Co. is up to its schedule of 50 light, high-speed motor trucks a day. The company is shipping its trucks about as fast as they are produced. There are evidences that the farmers are now in a more optimistic mood.

Service Truck Preparing to Start on Polish Order

WABASH, IND., March 4—Production on the new model Service truck, begun Feb. 15 on a four-a-day basis, has been maintained, and the working force at the plant is being augmented preparatory to starting work on the order received from the Polish government.

The sale of a considerable quantity of gold notes in America to Polish families will be undertaken, it is said, by the same syndicate of Polish bankers that underwrote the order for Service truck equipment.

More Optimism Felt Than in Two Years

Dealers Say Trade Is "Good," "Big," "Bright" in Reports to Manufacturers

NEW YORK, March 3—Nearly 100 representative members of the National Automobile Chamber of Commerce who attended the meeting here yesterday were more enthusiastic than they have been for two years over the business outlook. Roy D. Chapin, president of the Hudson Motor Car Co., who presided, declared conditions were better than at any time since the depression began. He based this assertion upon reports from manufacturers and dealers all over the country.

These dealer reports were practically unanimous in the statement that February business was materially better than January. One striking fact disclosed by the survey is that the situation in agricultural sections has improved. Even in the Dakotas the tone is much better. Only one of the many reports described business as not so good.

Prices Stabilized

Dealers used such adjectives as "good," "big," "bright" and "better" in describing the outlook for sales this month and next. This optimistic forecast was based on the belief that prices have been stabilized and that was the unanimous plea of the dealers.

Truck as well as passenger car sales have improved, and the demand for commercial vehicles is growing steadily.

Sales of high priced cars in the New York Metropolitan district were 39 per cent larger in January than in January, 1921. Sales of low priced cars were 259 per cent larger. Sales in the \$1,000 (wholesale) class doubled in January, as compared with December, and in the \$500 class they almost doubled. The greatest decrease in the January sales as compared with December was in the class above \$4,000 and in the \$1,500 class. Sales of ½-ton and ¾-ton trucks more than doubled.

National Shows Most Successful

A report made to the members on the New York and Chicago shows disclosed that they were the most successful ever held from the standpoint of attendance. A return of 77 per cent of their footage costs was ordered for members who exhibited at the New York show and of 91 per cent to those who exhibited at Chicago. This was in addition to retaining \$25,000 in a trust fund for a show building. This fund will be used as a guarantee that a suitable exhibition place will be available in New York.

HYLAN URGING BUS VOTE

NEW YORK, March 7—Mayor Hylan has sent a telegram to every member of the Legislature asking them to vote for his bill, empowering the city to spend \$25,000,000 for the purchase of city buses.

Industry Employs 11,149 More Hands

**6.5 Per Cent Increase Reported
During February—Instances
Cited in Government Survey**

WASHINGTON, March 7—General increases in employment were reported in the automotive industry during February, according to a survey by the United States Employment Service. The largest gain in employment was noted in "vehicles for land transportation industry," which consists principally of automobile and accessory manufactures. The amount of increase in employment under this classification during February amounted to 11,149, an increase of 6.5 per cent from Jan. 31.

A study of the relative weights of the 14 groups covered by the survey shows that the vehicular industry employed 11 per cent of the total reported employed in all groups on Feb. 28. As illustration of the growth of employment in the automotive industry, it is pointed out that in Springfield, Ill., a tractor plant is steadily adding to its forces; some automobile plants have reopened in Indianapolis, and the erection of a new large truck plant will start on March 16 in Fort Wayne, Ind.

8500 in South Bend Plant

A large automobile corporation in South Bend is now employing 8500 men and will have 10,000 on the payroll before the summer. In Cleveland one motor company, the city's largest manufacturer of motor cars, has given employment to hundreds of men and the production has increased 50 per cent. In Dayton, a rubber company reports 150 per cent increase over last year, and is going full time day and night.

The economic pendulum that started on a downward swing in December and continued through January took an upward turn in February. While the joints of industry are still stiff, yet there is a resiliency to business that is very encouraging and with every indication of permanency.

Employment increased in all industries with the exception of textiles, which shows a marked decrease, due to the industrial controversy existing in the New England district. The basic industries, food, iron, steel and metal products, railroad repair shops, and vehicles for land transportation, made substantial gains.

Reports from 231 of the principal industrial centers, with but few exceptions, show a general improvement in employment conditions and an enthusiastic spirit of hope and confidence in the future. Weather permitting, March will begin an era of great activity.

BEST JANUARY FOR HUPP

DETROIT, March 7—President Hastings of the Hupp Motor Car Corp. announces that shipments in January were the largest for any January in the history of the company. He reports that

DETROIT FIRMS SHOW GREATER EMPLOYMENT

DETROIT, March 6—Substantial evidences of steadily increasing production in the automotive field is found in the employment reports of the 79 firms which are members of the Employers Association. The statistics for the first eight weeks of 1922 follow:

Week Ending	Number Employed	Net Change
Jan. 2	60,981	Inc. 8,795
Jan. 10	102,485	41,534
Jan. 17	109,703	7,218
Jan. 24	111,615	1,912
Jan. 31	113,099	1,484
Feb. 7	115,092	1,993
Feb. 14	118,647	3,549
Feb. 21	121,048	2,407

four times as many cars were shipped in January last as in January, 1921, twice as many as in January, 1918 or 1916, and three times as many as in January, 1919.

Liberty, with Many Orders, Enters Heavy Production

DETROIT, March 7—The Liberty Motor Car Co., with a long string of orders piled up from the early 1922 shows, has entered upon a period of heavy production that will carry it through to early summer. The output for March will exceed that of any month in 1921, and the program for April calls for production and shipment of more cars than for any month in the record year of 1920.

As an indication of the Liberty sales stimulus, the company declared that applications for retail sales rights were received from 53 dealers at the New York show alone. Nine factory territorial men have been added to the staff to handle applications for unoccupied dealer territory.

Cliff Knoble has returned to his position as advertising manager of the company after an absence of several months. The company is going in for an extensive sales and advertising campaign which will be launched about April 1.

Give Public Wide Use of Bus, Franklin Urges

SYRACUSE, N. Y., March 4—Restrictions of motor buses should be limited to safety requirements, in the opinion of H. H. Franklin, head of the Franklin Manufacturing Co.

"If the public chooses to travel by motor bus, it should have the unrestricted privilege," he said. "If the motor bus cannot give a cheaper and better transportation, it will not survive. There should be no restriction on the number of buses or bus lines even between the same points. There is no justification whatever for the excessive taxation. The motor bus or truck should not be taxed in any greater proportion than other vehicles. Let competition and experience shape the future of the motor bus, not restrictive regulation."

Investigating Auto Stores Transactions

**Department of Justice Takes
Hand in Affairs—Temporary
Receivers Made Permanent**

PHILADELPHIA, March 6—Judge Thompson in United States District Court to-day appointed as permanent receivers for the United Auto Stores, Inc., the temporary receivers, Francis F. Burch and Samuel E. Whitaker, remarking in open court that he was satisfied there was fraud and mismanagement in the conduct of the concern.

Judge Thompson's comment came in response to a demand from Abraham M. Rose, one of the attorneys for Edward B. R. Carrier, head of the United Auto Stores, that the company be permitted to function as a going concern.

Immediately after the receivers had been made permanent, Aarons, Winstein, Goldman & Stone, attorneys, filed a petition of bankruptcy against the United Auto Stores.

Joseph K. Kun, assistant district attorney, asserted that the only hope for the creditors was in a permanent receivership. He further said that he had figures to show that in the last two months the stores lost \$55,000 and that the corporation's overhead for salaries alone came to \$9,300 a week.

Washington Orders Action

Agents of the bureau of investigation of the Department of Justice have taken a hand in the affairs of the United Auto Stores. It is asserted that if there is evidence that Federal laws have been violated arrests will follow immediately. Orders to investigate the company came from Washington.

Two agents have been assigned to investigate every transaction between the United Auto Stores Co. and the United Guaranty Co., which sold stock for the former company. Postoffice inspectors also are conducting an investigation into the affairs of the concern.

Budd Wheel, with 50 Service Stations, Expanding System

PHILADELPHIA, March 6—The Budd Wheel Co., which now has more than 50 service stations located as far as possible with well established wheel dealers and repairmen in the larger cities of the United States and Canada is steadily expanding its service system.

All of these stations are carrying spare parts for both wire and disk wheels, in addition to an assortment of wheel parts and equipment. The service stations are also prepared to make repairs on wheels, and they soon will be provided with apparatus for straightening disk wheels. Inasmuch as the Budd Michelin disk is manufactured to the same dimensions as the Michelin wheel in Europe, it is possible for these stations to equip imported cars.

Factory Supervision, Show Need, Miles Says

**In Report to N. A. C. C., Manager
Recommends Better Sales-
manship at Booths**

NEW YORK, March 4—Better salesmanship is needed before the automobile shows can realize their maximum possibilities, S. A. Miles, show manager, says in his report to the members of the N. A. C. C. Conditions at Chicago were somewhat better than at New York, he states, due largely to the efforts of the Chicago Automobile Trade Association which offered daily prizes for the best salesmanship and kept up constant investigation of conditions.

In his report, Miles says:

No matter how successful the shows may have been in the matter of financial returns, I feel that we have a further responsibility in determining to what extent they have been successful in other ways and what steps are necessary to insure their permanent value. It has probably become evident to most observers that salesmanship in the automobile industry has not reached the peak of perfection.

Influence of Past Bad

For fifteen years or more we have enjoyed a condition which, in some respects, has an unfortunate influence on some of the salesmen of today. In many cases it has not been necessary to devote great energy or skill to the sale of cars. Some of our salesmen have grown into the habit of being approached rather than approaching.

Miles relates the experiences of some of the representatives appointed by the Chicago association to observe conditions at the booths during the show in that city. The manner of the salesman's approach, his general conduct and knowledge of the industry. These experiences showed lack of attention and general indifference to a prospect's wants, the salesman on occasions adopting the position of a booth attendant.

He then proceeds to state:

The lesson we may learn from these conditions is, I think, that the exhibits lack adequate supervision. Year by year the men at the top become more and more conspicuous at show time by their absence. This has been particularly noticeable at Chicago. On one day of the show, in an endeavor to obtain an answer to the question so frequently asked, whether any actual business was being produced, I made a personal visit to every exhibit in the Coliseum.

Few Factory Executives

My acquaintance in the industry is fairly extensive but I was able to find only three men of my acquaintance and only one of these was a factory representative of major importance. The same remark is true of casual visits made at other times during the week. It is also true of my visits during the New York show.

On many occasions it is necessary for us to get into communication with the gentleman named in the show contract as the official representative of the exhibitor. I think it perfectly safe to say that not once in four times did we find the representative

in the building. That the Chicago investigators reports are true, I know from the fact that not in a single instance during my trip through the building was I accosted by a salesman.

It is my belief that if the shows are to continue successful in all respects, a higher order of salesmanship must be developed under the eyes of the members and their higher class representatives.

Rubber Makers Start New Plan for Meetings

NEW YORK, March 6—The tire manufacturers division of the Rubber Association of America will inaugurate its plan of holding regularly quarterly meetings of the entire division at New York, or occasionally some other city, on Tuesday, March 21, when a meeting will be held at the Hollenden Hotel, Cleveland.

The executive committee of the division believes that the practice of holding an occasional meeting at Cleveland, Chicago or some other Middle Western city will be appreciated by many dealers west of Ohio who find it inconvenient to attend meetings in New York.

The Cleveland meeting will indicate whether the plan to hold meetings away from New York will result in increased attendance and interest.

Ford Owners' Association Is Object of Ohio Attack

CHICAGO, March 3—The State of Ohio has started a war against the operation of the Ford Car Owners' Protective Association, with headquarters in Chicago.

It is declared that the insurance concern has been doing business in Ohio without the authority of the State Insurance Department and that it has defied the department to interfere with its operations. The company did business at one time in Michigan, Wisconsin and Indiana.

One of the first steps against the association in Ohio came in the arrest of S. M. Green, district manager, under an indictment charging him with selling insurance without a license and with placing insurance with an unauthorized company.

Shareholders Must Pay Pan American Stock Notes

DECATUR, ILL., March 4 — Subscribers to the stock issue of the Pan American Motors Corp. will be called upon to pay notes they gave for such stock, although it is probable that common stockholders will get less than 20 cents on the dollar. A statement to Judge Baldwin, sitting here, shows that W. A. Phares, former treasurer, for whom a warrant charging embezzlement has been issued, owed \$13,465. Real estate and buildings valued at \$100,035.99 would bring about \$150,000, it is said, but this sale has not been ordered.

The service department of the company, which has been showing good profit, is under operation by permission of the court.

Bulletin Explains New Tire Warranty

**Accompanies Poster Sent by Rubber Association of America
to 125,000 Dealers**

NEW YORK, March 6—The Rubber Association of America has sent to approximately 125,000 dealers a poster on which is printed the standard tire warranty and claim form. Dealers are requested to display this poster prominently. With it the association has sent to each dealer a bulletin which says:

"The unsoundness of the former tire adjustment conditions is emphasized by the fact that clothing, footwear, household appliances and innumerable articles of utility (which are subject to service under conditions which the manufacturer cannot control or ascertain) are not sold with a definite guarantee of service and an unsoundly liberal adjustment policy. There is apparently no good reason why tires should be an exception. The abuse of the former condition in the tire industry tended to increase costs and the whole purpose of the present movement is to eliminate the economic waste.

Old Policy Costly to Dealers

"Entirely too many of the adjustments formerly made were what the industry knows as "policy" adjustments. The dealer loses most by that kind of an adjustment, because each tire thus furnished prevents a new sale by some dealer. It is no exaggeration to say that "policy" adjustments annually took millions of dollars from the pockets of the dealers alone.

"Under the standard warranty and claim form, only those tires which are faulty in material or workmanship will be considered for adjustment, and then only upon the basis outlined in the second paragraph of the warranty. Tires cannot be adjusted if run on wheels out of alignment, on shaky wheels or with lugs improperly tightened, causing unusual wear, or if damaged by either cuts, jabs or stone bruises, or by underinflation or overloading.

Annoyance Eliminated

"For the dealer, the new condition will eliminate much annoyance and loss of profit, and it should remove all apprehension that some other dealer is going to do the thing that you know to be unsound and unbusinesslike. The consumer will benefit, because formerly the careful user had to carry the burden created by the careless user. Now each user will pay his own way. If the tire is defective, the owner can get fair treatment provided he makes a claim in the specified manner."

ABRASIVE COMPANY SCHEDULES

NEW YORK, March 6—Schedules in bankruptcy have been filed by the Worcester Abrasive Co., Inc., manufacturers of automobile grease valves. Liabilities are listed at \$21,868 and assets at \$7,700.

Vote Amalgamation of Northway Firms

**Assets of Three Companies Pooled
—To Issue \$400,000 8 Per
Cent Gold Notes**

NATICK, MASS., March 7 — The Northway Motors Corp. met to-day at the factory, and with 250 stockholders present, it was voted to amalgamate the three corporations bearing the Northway name, the Northway Motors, Northway Motors Sales Corp. and Northway Motors Guarantee & Discount Corp. All the assets of the three companies were pooled with the formation of the new corporation, and it was voted to issue \$400,000 8 per cent three year gold notes, and the stockholders were asked to make contributions of 10 per cent on their stock.

The plant, at present, is almost shut down, but it is expected to be opened this week and production started on incomplete trucks. There is material on hand amounting to \$500,000, on which there is an indebtedness of \$100,000. To complete 200 trucks nearly finished will take \$120,000, and when sold they will bring \$780,000. The loss last year was \$217,000.

The directors elected were: Judge Henry C. Mulligan, Reginald C. Heath, Frank V. Noyes, Stephen W. Holmes and R. E. Northway. William Caswell was chosen treasurer and Robert Holmes secretary.

New Oldsmobile Model Has Added Equipment

LANISING, MICH., March 4—A new body, known as the model 37 super-sport car with a number of items as additional equipment which are standard on this model, has been put out by the Olds Motor Works. The car is upholstered and completely trimmed in maroon leather. It is painted jersey brown. The car is equipped with Tuarac disk wheels, individual cast aluminum bracket type steps with molded rubber tread and individual bicycle type fenders with splash aprons.

In addition, the following features are standard equipment: Gabriel snubbers on rear, triple bar steel bumpers, Boyce deluxe motometer mounted on a bar type of radiator cap, windshield cleaner, cigar lighter, double plate-glass windshield wing, stop signal, cowl ventilator, spotlight mounted on left front fender apron, step light for both rear doors and a bevel glass, rear-view mirror. There is a leather top boot and a carrier for two extra tires. This car, complete, as described, is priced at \$1,825.

FORD IMPROVES EQUIPMENT

DETROIT, March 6—A new type headlamp lens, known as the Ford H, is now being fitted as standard equipment on all Ford cars and is being supplied to branches and dealers for service and replacement. The lens has vertical flutings and is used in connection with a

21 candlepower gas filled bulb with clear glass. The lens is said to meet the requirements of all state laws.

Other improvements that have been recently made are the improved wiring system, which meets the requirements of the Fire Insurance Underwriters, the pressed steel muffler which replaces the muffler with cast ends and brackets, the redesigned pistons and connecting rods which have been made lighter, the one-piece runningboard brackets, the improved fan assembly, the new design starting switch and the dash weather trough to keep water from the coils.

Timken Axle Denies Combination Report

NEW YORK, March 8—A. R. Demorey, president of the Timken Detroit Axle Co., has sent the following telegram to AUTOMOTIVE INDUSTRIES:

"Recent rumors concerning the Timken company cause us to feel we should clearly state our position. We are not in a combination with parts makers, either in the sale of units or servicing nor are we in any combination with any automobile or truck manufacturer. The Timken Detroit Axle Co. is in business to manufacture axles and sell them to anyone willing and able to buy and pay for them.

"It happens that for the purpose of servicing the users of our products we are selling parts to a number of parts stations, who also happen to sell the products of other well known unit makers, but this is purely an arrangement between us and the parts station, and not a group arrangement between the unit makers. We feel we owe this statement to ourselves, to our customers and the trade in general.

"Briefly our position is this: We are axle manufacturers. We own and control our business and consider every automobile and truck manufacturer as a possible customer. Every arrangement we have is a very simple contract for the sale of axles at a definite price. Our interest in the customer we sell to is purely one of servicing as a unit maker."

NEW MARMON SPEEDSTER

INDIANAPOLIS, March 6—A new 4-passenger speedster is now in production at the Marmon plant. It is a decided departure in appearance from the other open cars and gives an effect of length and lowness. Equipment differing from that of the open cars includes a trunk rack at the rear, spare wheel mounted in a saddle sunk in the left runningboard, top bows of natural wood with nickel plated mountings. The price is \$3,950.

HOLLIS EXHIBITED

TIFFIN, OHIO, March 6—The Hollis electrically driven automobile model, which was constructed in Hollywood, Cal., arrived here this week and was placed on exhibition at the Hollis Tractor plant. The company, which has been working on its factory here for two years, is preparing for manufacture.

Will Capitalize New Maibohm at \$500,000

**Preferred Stock of Two Classes
Is Provided Under Present Plan**

TOLEDO, March 7—Creditors of Maibohm Motors Co. have been granted five days to authorize a new plan for the sale of the company to a syndicate of Sandusky citizens, represented by A. C. Burch as agent. The new company will be capitalized at \$500,000 in preferred stock of two classes. Class A will be 6 per cent cumulative, dividends commencing two years from date of issue. Creditors will receive this pro rata with their claims as finally approved. They will be represented by three directors on the board.

The new company will raise sufficient cash to take care of court costs, tax claims and will attempt to have Federal claim deferred. Total tax claims are \$76,000. A total of \$160,000 of new capital will be provided by the Sandusky interests. Preliminary offer contemplates a \$200,000 first mortgage and other liens not to exceed \$200,000 on the property.

A \$10,000 guaranty fund has been been posted by the purchasing company in the Third National Exchange Bank in Sandusky. The committee says creditors will receive 60 to 65 per cent of the face value of claims by this arrangement, and that it is the best which can be submitted. A bankruptcy sale would leave practically nothing for creditors after tax and prior claims were paid.

Two Models of London Placed on Exhibition

DETROIT, March 3—Two models of the London, a 6-cylinder car, made by London Motors, Ltd., of London, Ont., are being shown at the annual Windsor show this week. The car is assembled from standard units, Herschell-Spillman engine being used, together with Norwalk propeller shaft and universal, Warner gearset, Bosch ignition and electric equipment, Gemmer steering gear and Laminated wood wheels. The wheelbase is 126 in. Prices are phaeton \$2,700, sedan \$3,700, coupé, \$3,500, supreme phaeton \$2,900.

Production has been under way on a small scale at the London plant pending the opening of spring business. Many orders are reported to be on the books of the company. It is expected to bring out a 4-cylinder car later in the spring, the phaeton to sell at about \$1,400. W. R. Stansell is president and general manager of the company, and is also the designer of the car. The stock is mostly in the hands of London business men.

Most other cars at the show are Canadian editions of American cars: Studebaker, Gray-Dort, McLaughlin-Buick, Dodge, Chevrolet, Hupp, Reo and Ford. A Lincoln shown in the Ford exhibit attracted much attention.

Overland Phaeton Price Cut to \$550

In 1916 It Was \$615—Reductions
Made on All Willys-
Knight Models

TOLEDO, March 3—Price reductions on the open models of Overland cars and on all models of the Willys-Knight are announced by Willys-Overland, Inc. The price of the Overland phaeton and roadster is reduced from \$595 to \$550.

The Willys-Knight list follows:

	Old Price	New Price
Roadster	\$1,475	\$1,350
Phaeton	1,525	1,375
Coupe	2,195	1,875
Sedan	2,395	2,095

The price of the Overland phaeton only a year ago was \$1,035. It sold in 1916 for \$615. The latest reductions have been made possible, it is stated, by manufacturing economies, the liquidation of high priced inventories and the elimination of obligations for materials at high cost.

New List of Prices

Announced by H. C. S.

INDIANAPOLIS, March 6—The H. C. S. Motor Car Co., of which Harry C. Stutz is president and general manager, has announced a new list of prices. The schedule is as follows:

	Old Price	New Price
Phaeton	\$2,775	\$2,400
Coupe	3,450	2,850
Roadster	2,725	2,400
Sedan	3,650	3,150
All weather roadster....	.....	2,550
All weather phaeton....	.....	2,600

NEW DIXIE FLYER LISTS

LOUISVILLE, KY., March 6—The Kentucky Wagon Mfg. Co. announces price reductions on the various models of its Dixie Flyer, ranging from \$100 to \$350. The schedule follows:

	Old Price	New Price
Phaeton and Roadster...	\$1,195	\$1,095
4-passenger Speedster...	1,395	1,245
Coupe	1,895	1,545
Sedan	1,895	1,595

Rolls-Royce Phaeton Is Now Priced at \$10,900

SPRINGFIELD, MASS., March 7—A new price of \$10,900 for the Rolls-Royce phaeton is announced by L. J. Belnap, president of Rolls-Royce of America. This price is guaranteed and represents a substantial economy to Rolls-Royce customers. In his announcement, Belnap says that in the two years it has been on an operating basis, the company has determined its costs and perfected methods and organization in such a way as not only to equal but to excel the English-built car. He adds:

It is a fact that with the American mechanic, equally skilled as he is with the English mechanic, and excelling him as he

does in enthusiasm and initiative, due to more favorable labor conditions, we are actually building the Rolls-Royce in America, not only better than it has ever been built before but more economically. We have this advantage that, with our already acquired long experience in building Rolls-Royce cars in England, over here we have not suffered from many manufacturing difficulties and problems which would be eliminated only by beginning new, as we did here in Springfield, Mass.

CLETRAC F MODEL REDUCED

CLEVELAND, March 4—The Cleveland Tractor Co. has made a reduction in the price of its new Model F from \$795 to \$595. The company announces that production will shortly be increased from 20 per cent of normal to 60 per cent.

BEEMAN TRACTOR, \$240

MINNEAPOLIS, March 3—The Beeman Tractor Co. of this city has reduced the price of its Model G to \$240. This company now makes a smaller model known as Beeman Jr., which sells for \$180.

ARO PRICE DROPS

MINNEAPOLIS, March 6—The Aro Tractor Co. has reduced the price of its model E tractor from \$450 to \$385, f.o.b. Minneapolis.

British Exports Drop

While American Gain

WASHINGTON, March 4—Analysis of British automotive exports for December, compiled by Commercial Attaché W. S. Tower at London, shows a sharp decline as compared with the previous month. American shipments for the same month revealed an increase.

Exports of British made passenger cars for December show a total of 33, valued at £25,257; 14 trucks, £11,651, and 9 chassis, £13,866. Three cars and two trucks were sold in Brazil; 4 cars and 7 trucks in Argentina, and 2 chassis in this country.

Ford Service Policy

Also Will Be Lincoln's

CHICAGO, March 6—It is the intention of Henry Ford to make the service of the Lincoln car as complete as that of the Ford car just as soon as possible.

The following inquiries recently were addressed to Ford:

1—Is the flat rate system that has been so beneficial to Ford dealers and Ford cars to be put in effect for the Lincoln?

2—Is it expected that the Lincoln and Ford cars will be serviced through the same service departments?

3—Will you follow the well established Ford policy as to permitting parts of other manufacturers to be used on the Lincoln car?

4—Do you expect to make the Lincoln service as universal as Ford service?

The reply from Ford's personal office was as follows:

Answering your inquiry addressed to Mr. Ford, we desire to advise that Ford policies will gradually be put into effect in the Lincoln Motor Car Co. or as fast as it is possible to do so.

Guaranty Trust Co. Discusses Prices

Sees Industry at End of Revision
Period—Pre-War Comparison Impossible

NEW YORK, March 2—The Guaranty Trust Co., in discussing automobile prices in its monthly survey, states that "approximate stabilization of automobile prices is believed in the industry to have been definitely reached."

It then goes on to say:

The average price of 49 of the principal standard touring car models is now 22 per cent below the average price on Sept. 1, 1920, but the price of the greater quantity of cars sold represents a much greater reduction, some as much as 42½ per cent. This reduction has been brought about by a series of price cuts spread over more than a year, so that we now stand at what appears to be the end of the period of price revision rather than at the beginning. In view of known improvements and refinements in the product, no comparison of present prices with those of 1913 is possible or significant.

Smaller Reductions an Indication

This conclusion in regard to stabilization is based not only upon the amount of the average price reduction that has taken place, but also upon the progressively smaller price cuts made recently by leading manufacturers. Furthermore, at least six manufacturers have raised their prices since the first of the year, and there is justification for the belief in an apparent stabilization of the costs of the chief materials entering into motor car manufacture.

Many people believe that the prices of raw materials entering into the manufacture of automobiles have reached bottom. In the case of some of these materials a renewal of the upward price trend has been manifested. The average price of metals and metal products is now nearer the 1913 level than that of any of the nine groups, except farm products, for which the Bureau of Labor Statistics compiles price data. It appears, therefore, improbable that automobile production costs can go materially lower for some time.

Inventories have been well liquidated in the automobile industry and the industry brought to a sound position, where no justification of further general price reduction appears to exist.

Pennsylvania Railroad Takes Up Use of Trucks

BALTIMORE, March 6—The Merchants and Manufacturers Association has been informed by the Pennsylvania Railroad Co. that a plan for motor truck distribution of freight is under consideration for this city.

It is the belief of Robert C. Wright, general traffic manager of the Pennsylvania, that the vast volume of less than carload traffic congests the rails of the terminals and interferes with the proper handling of carload traffic. For that reason he believes it should be eliminated entirely from important stations and provided for by the construction of a large warehouse on the outskirts of the city from which store-door deliveries would be made by motor truck at the expense of the railroad.

Lighter Cars Meet Favor in Australia

Low Fuel Consumption, Selling Factor—Market Far from Saturation Point

WASHINGTON, March 7—There is a considerable demand for low and medium priced cars of American make in Australia. A study of the situation by A. W. Ferrin, formerly trade commissioner in Melbourne, shows that American cars retail in Australia at about twice the American price on account of the recent conditions of exchange, freight and other charges. Gasoline, all of which is imported, tires, and other supplies also cost about twice as much as in the United States, consequently the car with low fuel consumption and easiest on tires makes a stronger appeal than a heavier car.

One Car to 67 Inhabitants

The fact that Australia has only one automobile to 67 inhabitants indicates that the market is far from a saturation point. In addition, the average Australian income is higher than the American or Canadian, and the proportion of the population which can afford an American car is probably considerably greater than the possible percentage in this country.

It is significant to note that 90 per cent of the cars now in use in Australia are for purely commercial purposes, and the automobile is recognized as an important element of transportation on that continent.

American exporters of automobiles will be interested to know that the high initial cost and the high cost of operation, together with the light road beds, have so far been against the large use of motor trucks. A mistaken impression as to the economy of horse transportation is probably the greatest barrier to the spread of automotive carrying.

Better Roads Will Help

The average rural operator does not appear to have investigated the question of horse versus truck very scientifically, and it is difficult to find one who can tell just what it costs him to transport his products by wagon. There is little, if any, doubt that with the improvement of roads to the point of withstanding heavy traffic in all weathers, the motor truck will win its way in Australia. The first requisite of success for the motor truck is better roads; the second, wider education as to the value of motor transport; the third, greater technical knowledge in the rural districts, where the number of men who can now operate a truck is small.

Trucks are used in fair numbers in Sydney, the undulating streets of which are hard on horses, but not to any extent in the better paved streets of Melbourne, Adelaide, Brisbane, Perth and other large cities. Initial cost is the

chief objection to the commercial car in these cities.

The overstock of motor cars in Australia, which six months ago was seriously depressing the market, has been entirely cleared up, according to advices from Melbourne and Sydney, and importations of American cars have greatly increased. Australia was the third largest purchaser of American cars during 1921, and her imports of motor cars from the United States were three times as great as those from the United Kingdom.

Shipments of American cars to Australia numbered 3740 in 1921 and 3905 in 1920, a remarkable showing in the face of the adverse conditions prevailing during the first six months of the year, when the low conversion rate of Australian sterling, restrictions of remittances to foreign countries, and other factors were reducing all imports to a minimum.

Treasurer Is Appointed Miami Cycle Receiver

MIDDLETOWN, OHIO, March 8—Anthony H. Walburg, secretary and treasurer of the Miami Cycle & Manufacturing Co., has been appointed receiver for that corporation. The application was made by the company, but it was the result of a suit filed against it by the Empire Trust Co. of New York to force payment of notes. The company has outstanding \$371,900 in common stock and \$656,200 in preferred. The common is closely held. There is no funded debt.

The company was incorporated in 1894 to manufacture and distribute bicycles, coaster brakes, pedals, etc. The plant here covers an entire city block and contains a total floor space of 175,000 sq. ft.

Home Demand Sustains British Automotive Market

LONDON, Feb. 28 (by mail)—Were not the home demand for light cars exceeding expectations, Britain's motor trade would be on the verge of collapse. There is no demand for heavy types, though sales of medium cars are fairly satisfactory. Demand for side-cars, motorcycles and trucks are far below normal.

There is a possibility of further price reductions, for labor by now thoroughly realizes the position the trade is in. As matters stand, foreign sales must be accelerated if factories are ever to work at capacity.

CLEVELAND RE-ELECTS OFFICERS

CLEVELAND, MARCH 6—All present officers and directors were re-elected at the annual meeting of the Cleveland Automobile Co. held in this city. The company did not make public its financial condition, but it was stated that production at the factory is increasing. Between 35 and 40 cars were made daily in February, and Secretary J. L. Krall said approximately 1500 would be turned out in March.

French Offer Prize for Aviation Motor

Competition Open to Foreign Makers—Must Be Ready by March 1, 1924

PARIS, March 1 (by mail)—Two million francs are offered in competition for the best aviation engine for commercial service of either French or foreign construction. Details of the competition have not yet been decided, but it is probable that after a preliminary test of 5 hours on the bench and 2 hours on a plane at an altitude of 6500 feet, the engines will have to undergo a 240 hour bench test, in periods of 8 hours, the entire tests to be finished within 100 days. There will be penalizations for all stops, changing of parts or repairs.

The competing engines, which will have to be ready for the tests by March 1, 1924, must develop between 350 and 450 hp., and weigh less than 7.2 pounds per horsepower without accessories. The object of the competition is to develop a really reliable engine, capable of being used for long periods without overhauling for commercial flying.

Of the two million francs, one half is offered by the French Government and the other by a public committee. The Government million will be used to cover the expenses of the trials and to offer two prizes of 300,000 francs each for the most reliable French engine and for the one having the best economy with the lowest head resistance.

The million subscribed by the public committee will be used to purchase the winning engine if of French construction, or to purchase the manufacturing rights if of foreign origin. Entries for this competition are received until Dec. 1, 1923, the fee being 25,000 francs, of which half will be refunded. Foreign makers will have to deposit 10,000 francs to cover the cost of the bench tests.

Imports of Cars and Tires Declined in New Zealand

LOS ANGELES, Feb. 6—Official trade statistics for New Zealand record a substantial decrease in the imports of automobiles during 1921. The United States, which for the past four or five years has supplied fully 85 per cent of all cars imported by the Dominion, was particularly hit by the slump in the demand.

The number of motor cars imported by New Zealand in 1921 totaled 3843, compared with 11,994 in 1920 and 6100 in 1919. Imports of automobile tires also declined considerably. In 1921 tires imported were valued at \$715,306, compared with \$1,803,961 in 1920 and \$360,048 in 1919.

The drop in the total trade of New Zealand last year amounted to approximately \$19,000,000. The 1921 imports aggregated \$42,942,443, compared with \$61,595,828 in 1920 and \$30,671,698 in 1918.

Washington Shown Low Priced "Star"

Durant Responsibility Ends With Completed Car—Separate Distributing Organization

(Continued from page 582)

but many details remain to be worked out. Definite decisions have not been reached on all the parts which will be used and it is understood prices will be the determining factor. The phaeton will have a full five-passenger touring body of good appearance.

Official details still are lacking concerning the exact relations between the parts makers and Durant in the new venture. While sales plans have not been worked out, there is no reason to believe that distribution will be through the organization which Durant has built up for his own line, although the showing in Washington will be made with a background of Durant cars.

Offices for the Star Motor Car Co. have been rented at 511 Fifth Avenue. The Durant Corp., which handles stock sales for the Durant enterprises, is located in the same building. The new company has not yet been incorporated, and the names of those who will be the incorporators have not been disclosed.

Orders for June 15 delivery of the new car are being taken at Washington, and purchasers are guaranteed against a reduction of prices. The Star will be displayed in other cities before actual production is begun.

Durant headquarters characterizes as "interesting" a report that Durant has just completed arrangements for big banking connections in Wall street for his properties. The report has it that a large order for wheels was placed at a highly advantageous price because it was possible to pay cash. This report was responsible for a sharp upward turn in the stock of Durant Motors, Inc., on the curb market.

NO GERMAN FORD PLANT

DETROIT, March 8—Henry Ford denies reports that he proposes to establish a huge branch factory in Germany in which to manufacture cars, trucks and tractors. It is understood this plan was given consideration but later abandoned. An extensive business in Holland and Belgium is being done through the Antwerp assembly plant which was opened Jan. 1. The territory covered includes Switzerland and Luxembourg. The manager is Don Critchley, formerly of the New York branch.

VARNISH MEN MEET

BROOKLYN, March 6—The plant managers of the New York and northern New Jersey section of the National Varnish Association at their twenty-fifth meeting elected Frank M. Schumann chairman and E. J. Cole secretary. Both are connected with Hilo Varnish Corp. The subject discussed at the meeting was "Driers and Drier Specifications," in

First Engineering Details of New "Star," Car Durant Is Building

NEW YORK, Mar. 7—The first engineering details of the new Durant built "Star" were learned here today. The car is to have a wheelbase of 102 in. and will weigh about 1800 lbs. The engine will be a four cylinder Continental with bore of $3\frac{3}{8}$ in. and stroke of $4\frac{1}{4}$ in. A number of details and engineering features are not yet definitely settled.

The four cylinders will be cast in one piece with the upper half of the crankcase, a conventional L-head construction being employed. Whether the distribution will be by gears or chain is unsettled.

Pressure lubrication will be supplied through a hollow camshaft, to main bearings, with splash to connecting rods. The electrical units will probably be of Auto Lite make, with conventional drive, probably off the water pump shaft for the generator. Bendix drive will be used on starter, which will engage with toothed flywheel in usual way.

Water circulation through a flat tube type of radiator will be by centrifugal pump. A belt driven fan is provided. The engine will be mounted by four-point support on cross members, and not attached to main frame.

The layout of clutch, gearset and frame is similar to that used in the four-cylinder Durant, the gearset being mounted as a separate unit amidship, and connected with engine by universal joints which are not of the fabric or all-metal type, but a combination of the two without metal-to-metal contact.

The clutch is almost identical with that used in the Durant, being of the single plate type with direct acting springs and multiplying levers for disengagement. Clutch facings are of the molded type and are allowed to float.

The gearset is a conventional three-speed type, similar to the Warner gearset used in Durant cars, but may or may not be made by the Warner Gear Co. A longitudinal tubular frame member which serves also as a muffler is employed to minimize torsional deflection with accompanying body troubles.

Side members of the frame are straight $1\frac{1}{2} \times 4$ in. channel, arranged to accommodate light commercial as well as open and closed passenger bodies. All springs are semi-elliptic. Details of rear axle are not settled, but it will be semi- or three-quarter floating Timken, with Timken bearings and 10 in. brake drums accommodating both sets of brakes. Front axle is of I-beam type and has Timken wheel bearings. Hotchkiss drive and two Spicer joints are employed. Steering gear will probably be of worm and wheel type, but this and the make to be used are unsettled.

No special light truck chassis with longer wheelbase and heavier rear axle is contemplated at present.

which Dr. Percy H. Walker of the Bureau of Standards took part. The next meeting will be held March 16 when the subject to be taken up will be "Cost of Trucking and Its Inclusion in Cost Accounting Systems."

Detroit Has Reciprocal Exchange Insurance Plan

DETROIT, March 7—The Detroit Automobile Inter-Insurance Exchange has been organized as a reciprocal exchange insurance plan to furnish all forms of automobile insurance at cost to members of the Detroit Automobile Club. Actual writing of insurance will begin with the issuance of a charter.

Rates of the new insurance at the outset will be 10 per cent lower than the conference rates. This will be lowered as a surplus fund is accumulated.

LOWMAN BILL ADVANCES

ALBANY, March 9—The Assembly has concurred with the Senate in the passage of the Lowman bill, which is intended to regulate the size and weight, capacity and rate of speed of motor trucks, trailers and omnibuses and authorize the state highway commission to inspect motor vehicles to detect overloading, inadequacy of the equipment and other violations.

Gasoline Consumption Greatly Exceeded 1920

WASHINGTON, March 6—Refinery statistics for the calendar year 1921, compiled by the Bureau of Mines, shows that the domestic consumption of gasoline for 1921 exceeded the previous year by 260,000,000 gal., and 1919 by 1,081,000 gal. The daily average of production in 1921 was 14,119,313 gal., with a total production for the year of 5,153,549,318 gal. The total production during 1920 amounted to 4,882,546,649 gal. Exports and shipments for 1921 amounted to a daily average of 1,511,000 gal., or 283,000 gal. less than the daily average of exports and shipments for 1920.

On Jan. 1, 1922, there were 303 refineries, with a total daily indicated capacity of 1,736,725 barrels operating in the United States as compared with 828 operating plants having a daily indicated capacity of 1,714,395 barrels on Jan. 1, 1921. These plants were operating on a basis of 80 per cent of their indicated capacity on Jan. 1, 1922, and 84 per cent on Jan. 1, 1921.

During the year 1921 the petroleum refineries of the United States ran 75,325,670 barrels of Mexican crude oil; 2,745,015 barrels of Mexican tops and 160,557 barrels of Mexican crude naphtha through the stills. The Mexican crude run exceeded 1920 by 19 per cent.

France Still Seeks Own "National Fuel"

Government's Present Substitute for Foreign Gasoline Not Proving Satisfactory

PARIS, Feb. 28 (by mail)—With cash prizes of \$50,000 for an alcohol fuel competition, and a Government subvention of \$80,000 for laboratory experiments, France is making a serious effort to produce national substitutes for foreign gasoline. There is on the market at the present time a Government mixture known as "national fuel" which is composed of 50 per cent German benzol and 50 per cent French alcohol. This is used by the Paris omnibus company with not altogether satisfactory results and has met with hardly any success elsewhere.

An important competition is about to open at Beziers, in the south of France, with direct government support, with a view to the development of a national fuel on an alcohol basis. The program provides for bench tests of different classes of fuels presented by the competitors.

Says Program Is Impossible

It is impossible for the present French program to solve the gasoline problem of France, declares Maurice Goudard, president of the Solex Carbureter Co. Goudard indicated that the efforts to enforce the use of alcohol is only an attempt of the farmers and wine growers of France to put an additional tax on automobile users. If it is made compulsory for automobiles to use alcohol fuel, this will open up a rich market for the beetroot growers of the north and will leave the southern-produced alcohol free for marketing, without competition, for human consumption.

French national fuel is very international, says Goudard, for only the alcohol is produced in France, the benzol or gasoline mixed with it having to be imported from abroad. In case of war the whole of the French production of alcohol would be taken over for making explosives and the bottom would drop out of the national fuel program.

The French automobile industry is being crippled by the high price of gasoline, which costs five times more than in pre-war days, despite improved and more economical methods of handling. The average increase in the cost of commodities in France is three times the pre-war standard, while in the case of automobiles the coefficient is less than 3. Goudard considers that the final solution of the problem will be found in synthetic alcohol and benzol.

ANOTHER ROAD SCHOLARSHIP

WASHINGTON, March 7—For the third consecutive year a four year university scholarship is being offered high school students by the Highway and Highway Transport Education Commit-

tee. The scholarship, which is being given by Harvey S. Firestone for the best essay written on the subject, "How Good Roads Are Developing My Community," is an award to encourage the study of highway economics. The essays must not exceed 700 words in length; they must be submitted not later than May 1, and all students of high school grade are eligible to compete.

Eastern Ford Dealers Are Guests of Company

NEW YORK, March 8—More than 500 Ford dealers from the Metropolitan district, New England and New York state were guests of the Ford company at luncheon at the Commodore Hotel yesterday. Several factory representatives were present, including W. A. Ryan, general sales manager; Frank Haddis and E. B. Hobart, superintendent of the parts department of the factory. They were the principal speakers.

Ryan referred briefly to the Lincoln car, saying that 15 a day now were being turned out, but that production soon would be increased to 35. He added that Henry Ford expected large sales for the Fordson tractor at the new price.

Output in February Gains Over January

(Continued from page 582)

Rapid improvement in sentiment is apparent in the agricultural districts, and the rising prices of farm products give every reason for confidence that farmers will be back in the market for automotive products in the near future. A questionnaire sent recently to representative farmers in the states of Washington, Idaho and Oregon brought the information that many of them intended this year to buy not only trucks but passenger cars. The farm market for light delivery vehicles is steadily improving. Export sales also are expanding.

Substantial sales of the more popular lines are being made in almost all parts of the country, and it now is certain that the first quarter will show a very large increase in business in comparison with the same period last year. It is not probable, however, that the second quarter will show so large a comparative gain because sales in those months of 1921 were surprisingly good.

While predictions are dangerous in a period of readjustment, it can be stated with reasonable confidence that passenger car sales this year will be fully as good as last, when they aggregated 1,500,000; truck sales will be considerably larger and the parts business very much better.

Conservatism Marks Outlook in New York

Metropolitan Distributors Regard Present Demands for Cars Typical of Season

NEW YORK, March 9—Metropolitan car distributors are approaching mid-March with an encouraging record of sales for the early part of the year and prospects of lively business up until about the end of June. The more experienced and farsighted merchants, however, are not letting present and immediate prospect business, even with its substantial increase over that of a year ago, lead them into anticipation of a heavy volume of sales for 1922. They see in the present condition of the market nothing more than the typical spring demand of a year that is expected to approach a little way toward what might be termed normal in comparison with the restricted business of 1921.

Distributors and dealers who can be induced to talk without putting "publicity" into their conversations do not predict that the present stimulation will go right on throughout the year. They frankly look for a quiet and, on some lines, even dull third quarter, and for a fourth quarter whose volume will be determined by the size and value of the 1922 crops and the reactions of the industrial and commercial centers to the harvest situation. Studebaker, Buick and Dodge are selling heavily, and good records are being made in a number of other lines, including Cadillac, Chevrolet, Overland and Ford.

The wholesale territory around New York is reflecting the metropolitan situation, and the general result, of course, is the placing of pretty sizeable orders with the factories. These are virtually for immediate delivery, as the veteran distributors see the need for sizeable stocks in order that they may not lose out on the demand which will exist during the next three months.

There is nothing in the New York situation, however, to indicate that any tremendous improvement over the sales records of 1921 can be expected. A thoughtful analysis of the situation suggests that in this territory the increase in business will be only a logical one, based on the absolute necessity for some replacements postponed a year ago and on the plainly apparent better feeling of the public regarding the future of business.

ASK URSUS RECEIVER

CHICAGO, March 6—Stockholders of the Ursus Motors Co., incorporated at \$1,000,000, have filed a suit for a receiver in the Circuit Court. The bill alleges that 4000 stockholders have been fraudulently deprived of approximately a million dollars. According to the bill, the company was formed to manufacture tractors and farm implements, and the money received has not been used for manufacturing purposes.

Adria Pays in Full; Factory Will Resume

Creditors Gave Consent to Extension on Payments at Meeting a Month Ago

BUFFALO, March 4—The Adria Motor Car Co. of Batavia has issued an announcement through President Vreemasak that it has paid its creditors in full and is now ready to resume its manufacturing operations suspended more than a month ago, when the company faced a cash shortage.

Extension on payments of accounts was given the company by its creditors when a general meeting of the stockholders and directors was held a month ago. At that time it was stated that payment in full would be made just as quickly as a refinancing plan could be worked out. The plan has now been carried through successfully, according to the company officers, and the corporation is prepared to meet its fullest business demands.

Vreemasak said that from September to November the company manufactured 15 cars and that 17 others were in process of manufacture when the factory was closed.

"Now we are prepared to go ahead fast again," he said. "One of our distributors has 15 dealers and has orders in writing for more than 500 cars. The company is about to build a new model, which we believe will be popular."

International Metal Acquired by Ternstedt

DETROIT, March 9—The Ternstedt Manufacturing Co. has acquired the International Metal Stamping Co. of this city, which occupies a modern factory building with a floor space of 110,000 sq. ft. especially constructed for the carrying of heavy equipment. All the assets have been taken over by the Ternstedt company, including plant, equipment and real estate.

The International Metal Stamping Co. has manufactured successfully automobile stampings, fenders and kindred parts. The Ternstedt company now has a total floor space of 500,000 sq. ft. devoted to the manufacture of automobile body hardware. It has operated on a full time basis during the entire period of depression.

Car Demand Continues in Southern California

LOS ANGELES, March 4—According to a recapitulation of the registration in Southern California of new motor cars and trucks for January, there is no appreciable falling off in the demand. This is the period of registration for all cars in the state, and because of congestion in the motor vehicle department new car reports have been held up. Local distributors are very much encouraged by

the records. A total of 4049 new cars of all makes and 369 commercial vehicles was registered.

The report shows that the nine other counties in this part of the state registered only 26 per cent of the total, the remainder being made up in Los Angeles county. There were 1472 Ford passenger cars and 186 trucks listed. Chevrolet was second, with Buick leading the field in cars of a higher price. Among the solid-tired trucks, Mack predominated 2 to 1.

In January 1921, a total of 2003 passenger cars of all makes was registered. January 1922 more than doubled this figure. Since the first of the year business has shown an upward trend, and despite the shorter period, February probably will show a gain over January. During the 30 days ending Feb. 20, there were 64 new Chandler cars sold and delivered in the city of Los Angeles, a new record for any 30 day period.

Plate Recommendations Adopted by Truck Makers

NEW YORK, March 4—At the general meeting of the truck members of the National Automobile Chamber of Commerce it was unanimously voted to adopt the recommendations of the Truck standards Committee as follows:

That the standard caution plate adopted by the Chamber in 1912 is more suitable for present requirements than any other form of plate.

That a more general use of this plate should be made and that the space provided for weights should be actually filled in.

That the manufacturer should recommend to the State Motor Vehicle Commissioner that no license be issued for a motor vehicle unless weights are properly filled in on plate at time of application.

Roses, Cake and Statue Given Leland on Birthday

DETROIT, March 3—A miniature replica in bronze of the St. Gauden's Lincoln, standing about three feet in height, was presented to Henry M. Leland on his seventy-ninth birthday in February by the ten original Lincoln distributors. The occasion of the presentation was made one of general participation by all employees and dealers, the former contributing a huge cake to the ceremonies and the latter a bouquet of seventy-nine American beauty roses. There was a general reception, in which speeches were made by Henry M. Leland and other officers. Henry and Edsel Ford attended.

LINCOLN TIME EXTENDED

DETROIT, March 6—An extension of time in which creditors of the Lincoln Motor Co. might file claims is announced by the Detroit Trust Co., receiver. The extension from March 1 to April 1 was made, it was explained, to permit the government to file a claim of the War Department, growing out of war materials contracts, and said to amount to approximately \$6,000,000. Other creditors are to benefit by the extension.

Suggests Bank Aid for Roads in China

Shanghai Editor Sees All Countries Lending Help in Highway Upbuilding

LOS ANGELES, March 4—If American, British, French, German, Japanese, Norwegian and other capital can co-operate harmoniously and profitably with the Chinese in the conduct of banking in China, it would seem that these institutions might assist in providing the much needed capital required for the construction of new roads and expanding the automobile trade in China, says the *Far Eastern Review* (Shanghai) in its special automotive number recently issued.

The field is declared to be wide and important enough for the creation of a special sino-foreign bank.

"That China offers one of the greatest fields for the expansion of motor traffic is being emphasized by the widespread demand for good roads, the organization of companies for their construction and the orders that have been placed for motor vehicles," says the leading editorial in the special issue. It proceeds to state:

Unusual Road Activity

A review of the market discloses an unusual activity in all sections of the vast country in opening up new communications for commercial and military purposes. While it is too early to say that road building in China has been taken up in that serious frame of mind that impels other peoples to gridiron their lands with arteries of communication, it may be said that a good beginning has been made, and, if funds can be found for continuous construction and maintenance, the future holds bright for the development of a huge market for motor vehicles of all kinds.

This phase of China's development can be traced largely to the fact that for eight years railway construction has been practically at a standstill, with very little hope that funds on a large scale will be forthcoming from abroad for the resumption of work. Cities and towns in the interior, which cannot hope to be connected by rail, are turning their attention to the cheaper method of road communication, which calls for little more than the use of the over-abundant local labor in grading, rolling and, in some cases, of breaking stone.

These encouraging signs are also traceable to the excellent campaign being carried on by the good roads movement in the interior. Could capital be more readily obtained for road-making purposes, a boom in the automobile trade would follow. Unfortunately, there is little security for foreign capital in such enterprises, other than that supplied by the central or provincial governments, and such advances would have to come under the scope of the consortium.

NEW NAME FOR MACK MAKERS

NEW YORK, March 9—The International Motor Truck Co. has called a special meeting of its stockholders for March 22 to vote on changing the name of the company to Mack Trucks, Inc. The annual meeting will be held the same day.

MEN OF THE INDUSTRY

William A. Henderson, until a short time ago connected with the Dort Motor Car Co. in the capacity of manager of its body plant at Kalamazoo, has become president and general manager of the Brooks-Ostruk Co., New York City. Henderson was associated with the Holbrook Co. of New York for more than seven years as factory manager and had entire charge of the designing, constructing and manufacturing ends of the business.

H. C. Smith, who has resigned from engineering work in the aviation department of the government with which he has been associated for the last four years, has been appointed district sales supervisor for Earl Motors, Inc., with headquarters at Evansville, Ind. He has had considerable automobile experience in both retail and wholesale work. His territory includes sections of Indiana, Illinois and Kentucky.

Harmon F. Fisher has been appointed as engineer, connected with Research Division, of the American Petroleum Institute. Fisher has been a consulting engineer and was previously engineer in charge of operation of the U. S. Government helium plant at Petrolia, Tex. At various times he has been connected with the Gellert Engineering Co., Research Corp., and Westinghouse Electric Manufacturing Co.

E. E. Peake, for the last ten years secretary and treasurer of the Kansas City Motor Car Dealers Association, has resigned. He was one of the organizers of the National Automobile Dealers Association and until his resignation in February had been president since its organization of the National Association of Automobile Show and Association Managers.

H. R. Hyman has been appointed advertising counsel for the Stutz Motor Car Co. of America. Hyman has had an extended experience in the handling of automotive advertising. For more than seven years he was identified with the Cole Motor Car Co.

Perry McGregor has been named superintendent of the Oakland Motor Car Co. engine plant, succeeding Emmet L. Page, resigned. He has been superintendent of the Saginaw Products Co. motor plant and held a similar position with Chevrolet for several years.

R. G. Craig has been named manager of the New York branch of the Dort Motor Car Co., succeeding F. L. Sanford, who resigned to join the Dodge Brothers field organization. Craig was formerly Dort manager of sales at the New York branch.

S. M. MacDonald and A. L. Haskell, manager and assistant manager, respectively, of the Boston office of the New York Lubricating Oil Co., have assumed active representation of the National Lubricants Co. in New England.

H. Stuart Hotchkiss, now president of the General Rubber Co. and the United States Rubber Plantations, Inc., has been chosen vice-president of the parent company in charge of all overseas activities.

Francis W. Davis has tendered his resignation as consulting engineer of the Pierce-Arrow Motor Car Co. to take effect April 1. He will probably engage in consulting work in the fall.

Edward H. Hart, formerly general counsel of the Federal Reserve Bank of New York, has been elected vice-president in charge of legal matters of the United States Rubber Co.

A. C. Galbraith, formerly with the Mason Tire & Rubber Co., is New York City representative for the Republic Rubber Co.

W. G. Kimball, vice-president of the Columbia Trust Co., New York, has been elected a director of the Pierce-Arrow Motor Car Co.

H. C. Bowen has resigned as advertising manager for the Rauch & Lang Co., Chicopee Falls, Mass.

American Truck Finishes
Run in Argentina Test

WASHINGTON, March 9—Agents of American firms in Argentina anticipate that the results of the recent truck tests will have a salutary effect upon the sales in that country. The official tests for speed and economy when loaded to capacity and operated over dirt roads, as conducted by the Argentine Army, showed that the one American entered in the competitive race finished the entire course in a very satisfactory manner, running from Buenos Aires to San Francisco; from there over a dirt road to the National Encampment at the Campo de Mayo, and after various tests at the Army Camp, returning to Buenos Aires via Moron.

The three other trucks competing (Krupp, Mercedes and Opel) of German manufacture, were forced to abandon the test before reaching Campo de Mayo.

MAY BUY CHRYSLER RIGHTS

TOLEDO, March 7—Frank Kennison, one of the receivers for the Willys Corp., has been informed that Clement Studebaker, Jr., Rollin H. White, president of the Cleveland Tractor Co., and Fred Zeder, former chief engineer of the Studebaker Corp., who designed the Chrysler six, are working out a plan to finance the purchase from the Willys Corp. the rights to manufacture the Chrysler six and have taken some preliminary steps in this direction. It is reported that if they are successful in their efforts the car will be produced at the plant of the tractor company.

COMMITTEE FOR JACKSON SHAFT

CHICAGO, March 4—A committee representing the holders of the \$100,000 7 per cent notes of the Jackson Motor Shaft Co., bearing a March 1 maturity date, has been formed. The stock of this company is owned by Earl Motors. As soon as the notes are deposited with the Chicago Trust Co., the bank will pay the interest and make arrangements for extensions. The company is considered by bankers to be solvent, but its affairs are entangled with Earl Motors. Both situations are expected to be cleared up in the near future.

SPEEDWAY FOR KANSAS CITY

KANSAS CITY, March 6—This city is to have one of the big motor car speedways of the country. The track and grandstand and other buildings will be constructed on land on which an option has been obtained, several miles east of the city. The Kansas City Speedway Association, which is promoting the undertaking, is headed by John A. Butler, with E. E. Peake, former secretary of the Kansas City Motor Car Dealers Association, as secretary and manager.

Ash Demand Growing
Southern Mills ShowOrders Received from Automotive
Industry Fill Books for Some
Weeks Ahead

ATLANTA, March 9—Evidence of the steady improvement being noted in automobile manufacturing throughout the country is shown in the increased demand for ash at the southeastern lumber mills, orders from this source having now reached a point where a majority of the mills cutting ash have ample business booked for some weeks ahead. This demand has been unusually active for the past month and has been increasing steadily every week, with present indications portending still further improvement during March.

Ash prices have remained comparatively firm since the first of the year, but millmen generally are expecting increases within the next few weeks if orders continue to be booked in the present volume from the automobile trade. Due to the tendency on the part of some of the smaller mills to accept orders at below the market that they might obtain a quick turnover of their stock, prices are rather inclined to be bullish. However, this is not seriously affecting the situation.

Present prices for ash, tough white cane, band sawn stock, f.o.b. at the mills, only the principal items being included, are quoted as follows by the larger dealers: 4-4 ones and twos, \$80; 4-4 No. 1 common and selects, \$36; 4-4 No. 2 common, \$18; 4-4 No. 3 common, \$10; 8-4 ones and twos, \$85; 8-4 No. 1 common and selects, \$42; 8-4 No. 2 common, \$20.

Tokio Buys Truck Fleet
for Disposal of Sewage

TOKIO, Feb. 10 (by mail)—The City of Tokio has purchased a fleet of 47 trucks to be used for the disposal of sewage. Of these, 35 are one-ton Fords, pneumatic-tired, which will be fitted with covered rack bodies of Japanese construction. The remaining 12 are Packards, Model EC, complete with electric starting and lighting equipment and solid tires. Eight of the Packards will have Japanese-made vertical hoists and steel dump bodies, and the remainder will be fitted with ordinary platform and stake bodies.

These trucks will be used to convey the night-soil from the residential districts to the outskirts of the city, where it is sold to the farmers. Tokio, like all Oriental cities, has no regular sewer system, and the use of motor transportation for the disposal of sewage has long been advocated by local motor dealers. If other Japanese cities follow Tokio's lead in this matter, a new and large market for motor trucks will be opened. The night-soil has been previously transported by hand cars pulled by coolies.

FINANCIAL NOTES

Fisk Rubber Co. for the year ended Dec. 31, 1921 shows net profit after depreciation and rebates but before interest charges, of \$3,336,467. After interest charges there remained a surplus of \$2,011,379. A charge of \$8,390,455 was made against profit and loss account. Surplus after payment of preferred dividends was \$1,494,464. After inventory adjustments and reserve for commitments there was a surplus of \$1,873,417, compared with \$7,789,085 on Dec. 31, 1920. The balance sheet as of Dec. 31 last showed cash, \$2,079,124; accounts receivable, \$8,713,714; notes receivable, \$824,871; deferred charges, \$1,419,425 and inventories, \$13,160,207. Accounts payable totaled \$1,274,583; notes payable, \$4,845,000 and depreciation reserve, \$4,103,570.

Replacement Parts Co., Kansas City, adjudicated bankrupt in Federal court in that city Feb. 11, has filed its schedules, showing \$64,714 secured claims and \$58,099 unsecured. The secured claims consist of two notes for \$25,000 and interest of \$1,833 due Myrtle B. Stillwell and Ada Bambach given for cash, and note secured by deed of trust for \$32,500 due Marlen E. Pixley with interest of \$2,464. The petition against the company was filed July 16, 1921, and delay in adjudication was due to the controversy springing out of circuit court litigation.

H. H. Franklin Manufacturing Co. for the first time is making a public offering of common stock independent of the preferred stock as part of its plans for financing its new four-cylinder model. An investor has the privilege of purchasing either preferred or common shares or both. Ninety per cent of the 285,000 shares of Franklin common stock at present outstanding is owned by officers, directors and heads of departments in the Franklin industry. The common stock, which is without par value, is offered at \$50 a share.

Wire Wheel Corp. shows net loss deducted from surplus for last year's activities of \$433,620. Included in this amount is operating loss of \$90,588, adjustment of the inventories to present market values and writing off the usual patent depreciation. The balance sheet as of Dec. 31, last, shows cash amounting to \$183,759; notes receivable \$115,337; accounts receivable, \$73,872; inventories, \$915,557; accounts payable, \$26,909; accrued taxes, etc., \$23,379, and surplus, \$1,130,065.

Lee Rubber & Tire Corp. for 1921 reports net profits of \$9,328 after all charges and inventory adjustments, equivalent to 6 cents a share earned on its 150,000 shares of no par common stock. This is contrasted with net profits of \$326,638 after charges and Federal taxes, or \$2.11 a share, earned in 1920. The company's net sales aggregated \$7,358,436, against \$6,705,930 in 1920. Its deficit after dividends was \$290,762 for 1921, as compared with a surplus of \$101,638 a year before.

Firestone Tire & Rubber Co. has declared a regular quarterly dividend of 1½ per cent on the 6 per cent preferred stock and 1¼ per cent on the 7 per cent preferred. A dividend on the 6 per cent preferred is payable April 15 to stock of record April 1, and on 7 per cent preferred May 15 to stock of record May 1.

Chandler Motor Car Co. has declared the regular quarterly dividend of \$1.50 a share on the capital stock, payable April 1 to stock of record March 20. The dividend is being paid out of current earnings. During the last two quarters the dividend was paid out of surplus, because of the depression in the industry.

Atlas Drop Forge Co., Lansing, paid a 50 per cent stock dividend and a 25 per cent cash dividend in February, the dividend being in reality the distribution of a surplus which has been accumulating over a period of eight to ten years.

International Motor Truck Co. has declared regular quarterly dividends of \$1.75 a share on both first and second preferred stocks, payable April 1 to stock of record March 21.

Kelly-Springfield Tire Co. has declared a regular quarterly dividend of \$1.50 a share on the 6 per cent preferred stock, payable April 1 to stock of record March 20.

Packard Motor Car Co. has declared a regular quarterly dividend of 1¼ per cent on the preferred stock, payable March 15 to stock of record March 1.

Sends Out Questionnaire
on Trade Body Activities

WASHINGTON, March 4—Correspondence between Secretary of Commerce Hoover and Attorney-General Daugherty regarding the legal status of trade associations has brought so pointedly to the front the necessity of a complete understanding of the functions, methods and accomplishments of national trade organizations that this subject is to be made an important feature of the convention of the National Association of Manufacturers to be held in New York City, May 8, 9 and 10.

The association has sent out a questionnaire to its members in order to develop an elaborate study of the work of trade associations. The questionnaire, among other things, asks as to the type and percentage of industries represented, the character of the membership of associations, whether composed of individuals, firms or corporations, etc., and purposes, scope and authority of the departments of the organizations. This data will afford an opportunity for the compilation of a volume of authentic information regarding the work of trade bodies.

TRANSPORT RE-ELECTS OFFICERS

MT. PLEASANT, MICH., March 6—Officers of the Transport Truck Co. were re-elected at the annual meeting of the corporation. M. A. Holmes continues as president and general manager, with H. E. Chatterton as vice-president and assistant general manager. A. E. Gorham is secretary and treasurer.

MUST USE AFFIX TO HUDSON

NEW YORK, March 6—The statement that Judge Learned Hand had granted the Hudson Tire Co., Inc., of Newark, N. J., a permanent injunction restraining the Hudson Tire & Rubber Corp. of Yonkers from using the word "Hudson" on its tires, was somewhat misleading. The court order permanently enjoins the Yonkers company from the use of the word "Hudson" without "some distinguishing affix thereto." In all other respects the temporary injunction against the Hudson Tire & Rubber Corp. was vacated.

BANK CREDITS

Written exclusively for AUTOMOTIVE INDUSTRIES by the Guaranty Trust Co., second largest bank in America.

During the past week call loans ranged from 4 per cent to 5½ per cent, as compared with 4 per cent to 6 per cent in the previous week. For fixed date funds, also, the undertone was easier and offerings were more plentiful. Quotations ranged from 4¼ per cent to 5 per cent for all maturities from sixty days to six months. The prime commercial rate remained unchanged at 4¼ per cent to 5 per cent.

The Federal Reserve statement as of March 1, 1922, showed a decrease of \$48,000, the net result of an increase of \$4,599,000 in gold reserves and a decrease of \$4,647,000 in other legal reserves. Total bills on hand declined \$570,000, while total earning assets showed an increase of \$57,371,000. Total deposits increased \$46,261,000. Federal Reserve notes in circulation declined \$1,070,000, and the reserve ratio declined from 78.1 per cent to 76.7 per cent.

The total reserves of the New York institution decreased last week \$22,247,000. Total bills on hand declined \$1,622,000. Total earning assets increased \$35,684,000 and total deposits \$24,439,000. Federal Reserve notes in circulation increased \$129,000, while the ratio of total reserves to deposit and Federal Reserve note liabilities combined decreased from 87.1 per cent to 84.1 per cent.

On March 3 an issue of 7 per cent 5-Year Gold Notes of the Argentine Republic to the amount of \$27,000,000 was brought out in this market.

Last week Bradstreet's Food Index number, based on wholesale prices per pound of thirty-one articles used for food, showed a gain of 1.9 per cent over the previous week, but a loss of three-tenths of 1 per cent from the corresponding week of the previous year.

The Swiss National Bank reduced its discount rate last week to 3½ per cent from the 4 per cent rate that has been in effect since August 11 last.

FORD MAY CLOSE CORK PLANT

DETROIT, March 6—Henry Ford is considering the advisability of closing his plant in Cork, Ireland, because of an attempt by the municipal authorities to coerce him into employing 2000 men instead of 1000. The Cork Corp. has decreed that the Ford company must comply at once with an alleged condition of the factory lease by employing a minimum of 2000 workmen for five years.

EXPORT TRUCK SALES GAIN

NEW YORK, March 7—Truck sales in the export field are increasing because of the strength of foreign exchange, according to M. L. Pulcher, general manager of the Federal Motor Truck Co. As typical of the way in which foreign orders are coming in, he cited one from India for thirty trucks.

INDUSTRIAL NOTES

Wharton Motors Co., Pittsburgh, states that it expects to start production at its new plant in Dallas some time this year. The company has an option for a factory site in Johnstown, Pa., where it will build a three or four-story building for the manufacture of passenger cars and trucks. Robert H. Campbell, who was former president of the Campbell Engineering Co., Chicago, and who has been associated with a number of manufacturers in the industry, has become associated as vice-president and chief engineer of the Wharton company. Thomas P. Wharton is president; E. W. Fluke, second vice-president, and L. D. Heckman, secretary and treasurer.

Grand Rapids Tire & Rubber Corp. re-elected L. A. Brown, C. G. Dyer, C. S. Dickey, H. H. Swan and M. J. Goldner directors at the third annual meeting, which was attended by three hundred stockholders. The officers remain as in the past. President Brown reported the progress made in distribution and outlined plans for expansion. Treasurer Dickey stated the company was in excellent condition financially with nothing owing but current bills and with a comfortable surplus in the treasury.

Auto Body Co., Lansing, has elected John W. Haarer, cashier of the City National Bank, secretary, to succeed Fred C. Ruch. J. Edward Roe continues as president. Harris E. Thomas is vice-president and W. V. C. Jackson vice-president and general manager. Ruch continues as a director. Other directors in addition to the officers are E. S. Porter, A. C. Stebbins, C. E. Bement and Richard Price.

Hendee Manufacturing Co. has made effective a wage reduction averaging 15 per cent. This applies to the entire factory force of 600, but varies according to the kind of work done. There has been no pay cut for the office force. A survey of wage conditions in other establishments preceded the readjustment. The plant continues to operate full time.

A. & D. R. Black, consulting aeronautical engineers of New York and Washington, D. C., have closed their office in the former city, due to the slow development of civil aviation, upon which their work was partly dependent. They are carrying on consulting work at Garden City, N. Y.

Greenfield Tap & Die Corp., Greenfield, Mass., has compiled a comprehensive telegraph and cable code intended for overseas and domestic customers. It is a five letter code and so arranged that it can be combined with the majority of standard commercial codes.

Fedders Manufacturing Co. of Buffalo has purchased the former Lantz marble works plant in Bridgeburg, Ont., with the purpose of refitting it and manufacturing radiators there. Seventy-five men will be employed at the start, the force to be increased to 200 later.

Northern Wheel Co., Alma, Mich., directors have elected Frank W. Ruggles president. A. C. Chapman has been named vice-president and general manager; J. W. Blakeley, vice-president; Orville Allen, secretary, and Charles O. Ward, treasurer.

Watkins Manufacturing Co., Ltd., of Canada will establish a central factory and distributing office in Syracuse. The company, which does reabbtting with special machinery, will employ at least twenty-five men in the Syracuse plant.

Franklin Tractor Co. plant at Greenville, W. Va., has been disposed of at bankrupt sale to H. E. Bullock of Chicago, who paid \$27,500 for the land and building and \$7,000 for the chattels and other machinery.

Timken Roller Bearing Co. has begun operations in its new factory branch at Walkerville, Ont., choosing this point as a distributing point for all Canada.

Universal Tool Co., Inc., assets will be sold by the receiver March 21 at the plant at Garwood, N. J.

Spanish Rates Lowered
on Automotive Imports

WASHINGTON, March 7—Confirmation of the reported decrease in the customs duties on automotive products in Spain has been received by the Bureau of Foreign and Domestic Commerce. The new rates, which decrease these duties materially and which again should open that market for American automobiles, are based on the c.i.f. value of the shipment at the Spanish port of entry.

The new duties, according to a statement transmitted from Hugh Chalmers, head of the tariff division of the Bureau, to Gordon Lee, director of the automotive division, show that American products are given a preference of from 5 to 30 per cent. The rates are as follows, the second category applying to shipments from the United States:

	First tariff	Second tariff
Automobiles	Ad Valorem	Ad Valorem
Chassis with engine and automobiles complete value up to 20,000 pesetas.....	30 per cent	25 per cent
Motor trucks, motor buses	30 per cent	20 per cent
Framework (armaduras) without motors, longitudinal bearers, suspensions, transmissions, gearings, and separate parts not specified, for automobiles.....	40 per cent	25 per cent
Vehicle bodies, all kinds	60 per cent	30 per cent

INSURANCE COMPENSATION BILL

ALBANY, March 4—A bill which would create the New York Automobile Owners' Mutual Compensation Association, in which all owners of motor cars would have to be insured at cost, has been introduced in both houses of the legislature. The bill would provide compensation for persons injured or the families of those killed in automobile accidents.

It is contended that not more than 25 per cent of the money which automobile owners now have to pay because of accidents ever reaches the injured persons or their families because of litigation, expenses and insurance company profits.

SHALER PLANT BURNS

MILWAUKEE, March 6—The plant of the C. A. Shaler Co., manufacturing tire repair apparatus and headlight lenses at Waupun, Wis., has been destroyed by fire with an estimated loss of \$300,000, which is partly covered by insurance.

METAL MARKETS

TO-MORROW'S unfilled tonnage statement of the United States Steel Corp will, in the present condition of the steel market, partake somewhat more than it would ordinarily of the character of a compass to the industry's future course. For the last two or three weeks producers generally have had their ears to the ground in an effort to determine whether the rumblings indicated a steady growth in the demand which would eventually justify an upward movement of prices or a relapse that would again defer hopes of increased spring demand.

The corporation's rate of operations underwent considerable expansion last month, and undoubtedly a large number of orders booked in February were filled in that month, thus exerting no influence at all on the unfilled tonnage at the end of the month. Whether to-morrow's report on the backlog of the corporation's orders shows a slight increase or a slight decrease its bearing on the state of the industry's needs is relative. For all that, however, its sentimental effect on the market's undertone will be in evidence. There has been no lack of effort to pave the road toward an upward price movement in the event that developments should be in the least favorable. "The head of one large steel company," a Wall Street publication said the other day, "declares the industry has definitely turned for the better and any one who buys steel at contract prices will consider himself fortunate before the close of spring."

While there is more diversification to the character of steel buying than there was a few weeks ago, the automotive industries are still the market's chief prop. The bulk of the steel bar business being placed at this time is for automotive rim section material. Improvement in the strip steel industry is solely traceable to broadened automotive demand. The relatively steady demand and market for sheets would be non-existent were it not for automotive buying.

Pig Iron.—Automotive foundries are melting more iron and there is a larger number of orders being placed. Buyers of more than hand-to-mouth tonnages seek concessions, however, and in most instances have been able to secure them so far. "For the moment, manufacturers are interested chiefly in volume," significantly remarks one of the large pig iron interests in its latest market letter, "looking to the future for prices which will allow a profit."

Steel.—Passenger motor car manufacturers have been specifying freely against the remainder of their first quarter 1922 sheet contracts and considerable business for second quarter has been placed in the last few days. Previous quotations continue to hold. Non-integrated sheet mills are showing more interest in sheet bars, which reflects the continuing demand for automotive sheets. A decidedly better demand for strip steel is noted. Alloy steel makers continue to broaden operations. Several fair-sized orders for bolts and nuts are reported to have been placed by automotive interests in the Middle West. Prices generally are fairly steady, the market, however, exhibiting an uncertain undertone.

Aluminum.—Automotive demand is reported to be on the up-trend. Following the sale of some sacrifice lots of 98 to 99 per cent virgin ingots at 16½c. the market is now on a minimum basis of 17c., with first hands asking from 18c. upward. One dealer points out that aluminum is again being used for automobile hoods in fairly large quantities.

Copper.—The outlook is for a slight recovery following the market's recent setback.

Calendar

SHOWS

April 3-16—New York, Second Annual Electric Automobile Show, Showroom of the New York Edison Co.
May 24-June 5—Barcelona, Spain, Automobile Show under Dealers' Direction.

FOREIGN SHOWS

March, 1922—Santiago, Chili, Annual Automobile Show.
March 10-July 31—Tokio, Japan, Peace Exhibition.
April 16-23—Mexico City, Annual Automobile Show, Auspices of the Automotive Division of the American Chamber of Commerce.
April 22-May 1—Prague, Czechoslovakia, Fourteenth International Automobile Exhibition.

May—Shanghai, Exhibition of Road Building Material.

May, 1922—Quito, Ecuador, Agricultural Exposition, celebrating Centenary of Ecuador. Automotive Section.

May 1-15—The Hague, Automobile Show, also Airplanes and Motorboats. Secretary, Spui 185, The Hague.

May 6-21—Scheveningen, Automobile Show.

May, 23-June 5—Prague, Motor Show, Hotel de Ville.

July 1-24—London (Olympia), Aircraft Exhibition.

Sept. 1922—Rio de Janeiro, Brazil, Automobile exhibition in connection with the Brazilian Centenary Association Automobilista Brasileira.

Sept. 15-20—The Hague, Automobile Show.

Oct. 12-23—London (Olympia), International Commercial Vehicle Exhibition.

November—London (Olympia), Automobile Show.

Nov. 10-Dec. 19—Brussels, Automobile Show, Palais de la Cinquantenaire.

Nov. 29-Dec. 4—London (Olympia), Cycle and Motorcycle Show, British Cycle Motors, The Tower, Warwick Road, Coventry.

CONVENTIONS

May 8-10—New York, National Association of Manufacturers.

May 10-13—Philadelphia, Ninth National Foreign Trade Convention of the National Foreign Trade Council.

May 16-18—Washington, D. C., Annual Meeting of the Chamber of Commerce of the United States.

June 11-15—Milwaukee, Annual International Convention of the Associated Advertising Clubs of the World.

June 26-July 1—Atlantic City, Twenty-fifth Annual Meeting of the American Society for Testing Materials, Chalfonte-Haddon Hall Hotel.

August 28-Sept. 2—Detroit, National Safety Congress.

Sept. 18-23, 1922—Rome, Italy, Second Annual Meeting of the International Chamber of Commerce.

S. A. E. MEETINGS

Detroit, Mar. 24, April 28, May 26.

June 20-24—White Sulphur Springs, W. Va., 1922 Summer meeting of Society of Automotive Engineers.

5,000 Trucks Needed by British Railways

Order Depends Upon Sanction Being Given to Legislation Now Pending

LONDON, Feb. 10 (by mail)—The group of British railways which is seeking legislative sanction to start an automobile road service has offered two modifications to allay the increasing organized opposition to the proposals. The companies agree not to concern themselves with passenger service and not to undertake to build motor trucks for their use. The former waiver interests bus lines particularly and the latter truck manufacturers. If the legislation is sanctioned, it will probably mean an order for 5000 motor trucks, chiefly from 1 to 3½-ton capacity.

As service will be an essential feature it would seem that truck makers would be able both to build and undertake maintenance of the trucks on a contract basis.

Ford Prices Lowered

British Fordson has been reduced in price to £120. Within a recent period it has fallen from £250 to £225, to £205 and to £190. For £250 the British farmer can buy a Fordson special power farming plant, comprising tractor, plough, cultivator, roller and mower, the price being about a third lower than was ruling less than a year ago.

MOTOR HORN FILM SHOWN

DETROIT, March 3—Harry G. Sparks, sales manager of the automotive equipment division of the Sparks-Withington Co., Jackson, spoke to 800 students of the Michigan State Auto School on "Motor Horns—How to Sell and Service Them." The Sparks-Withington film "Tooting Your Own Horn," which is a supplement to the Automotive Equipment Association "Ask 'Em to Buy" film, was run.

A motor horn assembly cut-out and a similar cut-out of a Sparton radiator, mounted for classroom work in the

school, were presented to the students. Sparks, in furthering the "Ask 'Em to Buy" movement, has addressed and shown the film to more than 200 assemblies of dealers' and jobbers' salesmen.

CANADA OPPOSES MORE TAXES

MONTREAL, March 6—Concerted action in protest against heavy increases in motor vehicle fees was planned at emergency meetings of the Automobile Club of Canada and the Montreal Automobile Trade Association. The taxes on passenger cars would be increased from 70 cents per horsepower to 90 cents, and on motor trucks to \$50 per ton capacity. It was pointed out at the meeting that the tax on a Ford car, for example, would be \$26.70 under the new rate as compared with \$8.75 in New York state. The tax on a McLaughlin would be \$33.90, on a big six Studebaker \$46.50, on a Cadillac \$42 and on a Pierce-Arrow \$66.30.

TIDEWATER CREDITORS AGREE

WASHINGTON, March 7—Creditors of the Tidewater Lines, Inc., owners and operators of a highway motor service in the District of Columbia and Maryland, have signed an agreement under which 20 per cent of the outstanding indebtedness will be paid up immediately and extending the period for the payment of the balance until Jan. 5. Meanwhile the company has several new directors and will pay on a cash basis. It is stated that this firm will purchase new equipment within a few weeks and make an effort to cut down maintenance costs.

STARTS JAPANESE SURVEY

TOKIO, Feb. 10 (By Mail)—William L. Irvine, special trade commissioner from the automotive section of the Department of Commerce, has already commenced an intensive survey of the local market. Irvine expects to remain in Japan for several months and will make a thorough investigation of the possibilities of Japan as a market for American automotive products. He has already met several of the leading dealers and will be offered every facility for his investigation.

Franklin Net Profit In 1921, \$452,489

Annual Report for Year Shows Sales Were 81 Per Cent of 1920

SYRACUSE, N. Y., March 8—The annual report of the H. H. Franklin Manufacturing Co. shows a net profit for 1921 of \$452,489, after taxes, depreciation and all reserves including a special reserve of \$550,000 to reduce inventory to current market value. Sales for the year equalled 81 per cent of 1920.

The comparative income account shows net sales in 1921 of \$22,543,484, against \$28,585,399 in 1920; cost of sales, \$22,090,995, compared to \$27,888,884.

Current Assets, \$9,369,420

The balance sheet shows total current assets of \$9,369,420, against \$10,940,752 in 1920. In the former figure the cash on hand equals \$1,192,529; accounts and notes receivable, \$543,795, and inventory, \$7,484,630. The 1920 total includes cash, \$1,748,295; accounts and notes receivable, \$591,203, and inventory, \$7,614,696.

The current liabilities for 1921 were \$4,084,630 and for 1920, \$7,368,180. The accounts and notes payable in 1921 stood \$4,004,630, against \$7,233,180 in 1920, and the Federal taxes, \$80,000, compared to \$135,000 in 1920.

EXHIBITING AT TOKIO

TOKIO, Feb. 5 (By Mail)—Several of the leading local dealers are preparing exhibits for the Peace Exhibition, which will open here March 10 and run until the end of July. Only a small part of the exhibition will be devoted to automotive products. Takata & Co. will exhibit an Isotta-Franchini chassis with eight-cylinder in line engine and models of the English Bean; Midzushima will show Renault enclosed cars, and Sale & Frazar, agents for Ford, Hupmobile, Franklin and White will have a large display. Other dealers have not yet announced their programs.

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Gasoline Bus or Trolley Bus —Which?

The author, who has had a broad experience both in this country and abroad, discusses the relative usefulness of each type of vehicle and carefully weighs the value of each in municipal transportation.

By Walter Jackson*

FEW facts will support the assertion that there is no place for either the track or trackless trolley in city transportation services. There are, however, just as few facts to support the assertion that there is no place for the gasoline motor bus in such services. Each has its definite place, and this article is written, not in an attempt to show the disadvantages of the trackless trolley, but rather to show the advantages of the gasoline bus. In a great many cities, both in this country and abroad, this form of transportation has proved its value both to the operator and to the public. It has certain definite advantages which could never be gained with the trackless trolley. However, the old adage of Sir Roger de Coverly, "There is much to be said on both sides," still holds true.

Counsel on this subject has been darkened by the nature of many estimates of cost published by manufacturers' representatives on both sides. They usually assume some general condition, such as intervals between vehicles and number of people to be carried a given distance. Cost of power, upkeep and depreciation are made as favorable to that particular writer's side as possible. The other fellow's estimates are magnified and his hopes belittled. Quite naturally we are led into a triumphant "Q. E. D.," proving that

only in a few exceptional cases may the other fellow have a look-in.

In real life, however, we find that this or that vital figure in the commercial estimate is decidedly different in the individual or specific case before us. Aside, also, from the question of cost, we find that other elements enter at times, such as flexibility of route, need for a mobile corps, fixed or intermittent traffic needs, legal technicalities, such as New York's and London's esthetic viewpoint of the public, and so on. For these reasons the writer will try to show in the following discussion how different conditions lead to different conclusions.

Since the cost of power is one of the three or four largest items in running either kind of bus, it is well to understand where this element is dominant in making a choice. The Tees-Side (England) case furnishes a good example, inasmuch as the writer studied this property in detail on the ground in the summer of 1921.

The territory served consists of a number of small steel mill towns, totaling 45,000 people. These towns are connected by but one main road which would be the only one available for any form of transportation. It followed, therefore, that no mistake could be made in using a fixed structure. The project of giving service to this district, covering a route length of some 5

*Consulting engineer.

miles, came up during 1918 when gasoline was not only extremely high priced (about 60 cents per imperial gallon), but also restricted in supply. On the other hand, one of the steel mills was prepared to supply electricity for 10 years at the very low price of 1.5 cents per kilowatt-hour. The difference in favor of electric power was about 8 cents per mile. During the earlier period of operation, when gasoline went still higher, the difference in favor of electricity, naturally, was increased.

It will be clear that the Tees-Side Railless Traction Board was fully justified in adopting the trackless trolley. The difference between gasoline and electricity was so great that it might well be expected to wipe out any possible advantages due to the greater earning power of a fully flexible bus. Besides, it has been pointed out that only one highway was available in any event. On the other hand, had gasoline prices been closer to those in this country, a different decision might have been in order, because a difference of but 3 or 4 cents might have been offset by the possibility of running the buses a few miles farther to the seashore. British summer days are long, and Britishers are so fond of the open air that in non-working hours the gasoline buses would be earning top-notch fares, whereas most of the trackless trolley buses are then idle. And this is a sixteen-bus installation, too.

Installation in Yorkshire

Within the same province, Yorkshire, is another trackless trolley installation. This is in the charming old city of York. There are but four buses run on a route $1\frac{1}{4}$ miles long through narrow streets that would not allow track operation in any event. In this instance we have a good example of how changes in the cost of power can affect the question of what trackless vehicle to use. At York the choice had to be made during 1920. The difference between gasoline and electricity costs was not so great as at Tees-Side, since power at York would be billed by the lighting department of the municipality at 2.5 cents instead of 1.5 cents per kw.-hour. But one year has produced a different picture, owing to a considerable fall in price of gasoline. We learn that the City Council is prepared to reopen the question before it decides upon the character of operation for running to the suburb of Clifton.

Generally speaking, the sane advocate of trackless trolleys for England bases his chief argument on the saving in power. Thus, an article in the Nov. 17, 1921, issue of the *Railway & Tramway World* notes a case where the difference is 8 cents (12 cents—4 cents) in favor of electricity. In other words, the trackless trolley is preferred because electric power is but one-third the cost of gasoline power. Does this ratio apply in the United States? Let us see.

Operating Costs

In examining the estimates of electrical manufacturers' engineers here, we find that a gasoline bus weighing 10,000 lb. is credited with but 4 to 4.5 m.p.g., whereas the gasoline bus makers aver that 7 m.p.g. is nearer the possibilities. If we compromise on 5.5 m.p.g. with gasoline at 27 cents per gallon, the cost per bus-mile would be approximately 5 cents.

On the other hand, the electrical man figures only 2.5 cents per kw.-hour, which at an overall energy consumption of but 1 kw.-hour per bus-mile would make the cost of electricity one-half instead of one-third the cost of gasoline. Actually, the condition would not be so favorable. Only the larger power plants could deliver kilowatt hours at the rate named. On one property with which the writer was concerned the cost of power was

really more than 3.5 cents per kw.-hour. Nor was it likely that the energy consumption per 10,000-lb. trolley bus would be as low as 1 kw.-hour per mile after lighting, heating and transmission losses were taken into account. Based upon foreign studies, the writer concluded that the trolley bus would take at least 1.25 kw.-hours per mile. This consumption at 3.5 cents per kw.-hour meant a power cost of 4.4 cents, or but 0.6 cent less than gasoline.

From the foregoing it will be plain that the cost of power as we find it in any given situation must control, and not some generalized cost. The Tees-Side property, with its 3:1 ratio, was justified in adopting the trackless trolley, but a property with only a $1\frac{1}{2}$:1 ratio in favor of electricity ought to do considerable thinking.

While platform labor is a heavy item in operating expense, it is common to both kinds of buses. Hence we need not discuss it here. In some estimates a factitious advantage is shown for one or the other by assuming a difference in schedule speed per hour, and so crediting the faster bus with a lower wage charge. In practice this is not likely to obtain in city extension, crosstown or suburban service because either type will meet the conditions. We can, therefore, proceed to the next disputable item—namely, the likely upkeep cost of each kind of trackless vehicle.

If experience with trackless buses actually in use in Great Britain for some years were to be our sole guide we would find a surprisingly small difference between the repair cost of trackless and gasoline buses. Bradford and Leeds show costs in excess of 10 and 12 cents per mile, with the more modern Tees-Side much the same. During like periods the larger British bus undertakings, such as Sheffield, showed 9 cents and upward. In the latter cases we are dealing with vehicles approaching the end of their careers. The repair costs of the Aberdeen and Edinburgh buses are approximately one-half as much because the buses are newer and more efficient. Much the same figure (4.6 cents) is given in the case of the York trolley bus, but this does not include body reinforcement charges which were assessed against the bus builder.

Maintenance Comparison

If this is the story of the past and present of gas and electric buses in England, what of the future? In this respect the writer was assured by J. B. Parker, the general manager of the Tees-Side system that his new 36-seat bus was not expected to exceed 5 to 6 cents per mile maintenance cost. Now, in the *Tramway & Railway World* article, previously mentioned, the writer thereof, although advocating the trackless trolley, states that the "additional maintenance of petrol engine over electric motor" is $\frac{1}{2}$ d. or 1 cent per mile. Compare this with the American assertions that the trackless bus will tend to cost but 4 cents to 5 cents per bus-mile against 8.5 cents to 10.6 cents for the gasoline bus. The British writer based his figures on a decade of experience with both kinds of vehicles, whereas the American engineers have been obliged to base their figures on trolley car experience and the operation of motor buses under jitney and other small-scale conditions. Let us hold fast to the fact that the Britisher's outstanding reason for using trackless is not because of its lower maintenance, but because of its lower power cost in so many parts of his country.

On a trackless trolley system, of course, it is also necessary to maintain the overhead line at, say, $\frac{1}{2}$ cent to 1 cent per mile run. If the trackless system were self-contained it would also have a substation to look after. These are additional upkeep costs that tend to

cut down the difference in upkeep costs between the vehicles themselves.

The cost of a trackless trolley bus of, say, 25-seat capacity is now some \$1,000 greater (\$8,000 against \$7,000) than a gas bus of like capacity. On top of this the trackless bus also has the special investment for overhead line (four wires) and feeder wire from substations which would result in almost doubling the investment charges in those thin traffic cases where the number of buses will be fairly equal to the number of miles of route. Even if the investment required was not double, the charges would tend to be higher because money for the trackless trolley equipment could hardly be raised at the favorable rates open to any reliable purchaser of gasoline buses. The obvious reason is that so much of the trackless trolley investment is special, whereas the gasoline buses could be removed at once if their user did not make good.

As an offset to this, the depreciation or amortization charges on the trackless trolley bus should be lower—possibly by 25 per cent or better. But this lies in the realm of conjecture and hope because control, drive and current collection are still in the “x” stage of the equation. The first few months of American experimentation have already brought half a dozen types into the picture.

As shop costs, roadway maintenance, wages, traffic management, etc., would be the same cost in either form of operation, it is needless to detail them here.

An ironical characteristic of communities in the past has been an insistent demand for electric railway service provided the new tracks were laid and the new poles and wires erected anywhere except on the streets occupied by the petitioners. In the end, of course, the line had to be built somewhere amid much gnashing of teeth at the tearing up of streets and the destruction or defacement of trees, etc. What would a residential district be likely to prefer to-day if it wanted mass transport? Would it accept tamely the idea of the old-style overhead with four wires in the air instead of two, or would it naturally desire a neat vehicle using precisely the same motive power as the hundreds of private automobiles and trucks running regularly over the highway? There is not much doubt as to the answer the public would give.

Good will is so essential to a mass transport organization that it can hardly afford to incur avoidable antagonism. Where the factors of cost favored the trackless trolley it might be good policy to let the public express its preference with the understanding that whatever system was adopted must receive compensatory fares, whether on a flat or distance basis. In the case of extension through factory districts, on the other hand, this esthetic point would not arise and the trackless would have much in its favor.

As a practical operating matter it is well to point out here that it is often an open question whether the extension should be a shuttle service from the old trolley terminus or whether it should be a combination of non-stop running between city center and trolley terminus, plus local service thereafter. The adoption of gasoline buses permits trial of both plans. The adoption of trackless trolley buses permits application only of the

shuttle plan, for it is not practicable yet to run trackless buses and electric cars under the same overhead structure for any considerable distance.

We now come to the preponderant factor from the money-making standpoint, that of relative earning power. Here the foot-loose gas bus is without a competitor. It is simply a question of determining whether its potentially greater earning power is exploitable enough to the point where it wipes out any greater overall expense. A few examples will suffice to illustrate this point.

One day as the writer sat in the office of the Sheffield Tramways he observed a poster on the wall advertising motor-bus runs to the Rivelin Valley to be given Sundays and holidays only. On inquiry he learned that the buses used for this service are part of the fleet which on business days is engaged in the company's trolley line extension services. For this holiday service the municipality receives a substantially higher rate of fare than for regular running. A cross-country example is the Birmingham & Midland Motor Omnibus Company, which runs scores and scores of overland routes every day in the week. But it is always possible to use a portion of the fleet to carry parties of friends from anything

like a football game to a festival play at Stratford-on-Avon, the routing and stop-overs being arranged according to the convenience of the customer.

So, too, in pre-war days the buses of Berlin were largely diverted on holidays from city to woodland travel.

These are merely examples of the shifting of the bus from business to pleasure travel. The opportunities for moving them from one line to another in metropolitan service is simply infinite, as will be discovered by anyone who studies the operations of a

concern like the 3000-bus London General Omnibus Company. To run, also, two, three or four times as many buses in one direction as in the other is no novelty at all.

The ability to get around obstacles, as in the case of parades, fires and other temporary obstructions, obviously is possessed only by the bus that is not tied to rails or wires. The value of flexibility in a given case where the best route was being felt out was brought home recently to the writer in connection with the abandonment of two low-traffic trolley routes. Instead of slavishly following the old routes with buses, the company has been trying out certain detours that will bring its vehicles into contact with more riders. In fact, during some hours it will make changes to attract people who would otherwise want to use their cars for the comparatively short run to the golf links. With the best will in the world, no one could have set down a trackless trolley route that would have been right and stayed right from the standpoint of maximum revenue from, and therefore maximum service to, the public.

The foregoing incident came up in a town of less than 25,000 population, where one would not expect many opportunities for diversity of use. Yet hardly had the buses been in use two or three weeks than a local fraternal club was greatly pleased to learn that it could engage one for the later hours when only part of the equipment was needed in the regular runs. The value of the bus fleet in keeping off competition is no mean

WHILE Mr. Jackson has not attempted to set forth all the factors that enter into the problem of the trackless trolley or bus, enough has been presented to make clear the point that there is no general answer to the question, that the assertions of the enthusiasts on both sides should be sifted item by item and that the less tangible but weighty factors of public good will, flexibility to meet emergencies and potential earning power must be studied as carefully as the comparative investment and running costs themselves.

factor, either. The trolley run to a nearby town is no longer the shortest or quickest way. It would be possible for a jitney operator to do much harm by running a competitive bus. He is not doing so, because the company can play the game of "freeze-out" a lot better than he.

Buses for Seasonal Work

No one will question that the gasoline bus is the only thing to use where the traffic to be carried is of seasonal or intermittent character, as to fair grounds, parks, etc. There are many situations, however, on the border line. Service to a college is a case in point. Analysis will show how many days in the year and how many hours in the day the college is in session and, therefore, in need of transportation. Then is the time to see whether the permanent or the removable service is better, all things considered.

Then, too, is the possibility of using the gasoline motor bus as a rush-hour relief, for the reason that it can give non-stop runs over a large number of streets, whereas it would be absurd to think of erecting half a dozen trackless trolleys for that class of running. Such auxiliary service might not pay in itself, but would help

to speed up the main traffic arteries and keep off the cost of street widening or of building elevated trackways or subways.

Finally, as regards overland running, there seems little chance for the trackless trolley at its present stage, owing to the fact that it could not meet the high speeds possible with small-capacity, high-powered buses. This field will probably build up to thousands of installations, small in themselves but imposing in the aggregate.

The foregoing discussion has not attempted to set forth all the factors that enter into the problem of trackless trolley or bus. It is hoped, however, that enough has been presented to make clear the point that there is no general answer to the question, that the assertions of the enthusiasts on both sides should be sifted item by item and that the less tangible but weighty factors of public good will, flexibility to meet emergencies and potential earning power must be studied as carefully as the comparative investment and running costs themselves. The apparent fact that there seems to be more opportunities for gas than electricity should not interfere with the acceptance of trackless or even track trolley where the cost of electric power and the permanence of good travel are unusually good.

A New Refractory Insulating Material

ISOLANTITE is a new ceramic product developed in France during the war for which superior qualities as a spark plug insulator are claimed. It is made by a new process which is said to improve upon the good qualities of porcelain and to obviate its defects. No glazing is required to prevent the penetration of water and oil, and the material can be milled, planed, threaded and drilled, the same as metal, and with the same degree of accuracy.

Tests of the physical strength of Isolantite were made at the French Government Laboratory in Paris. These tests were made on two series of cylinders about 0.8 in. in diameter and of the same length. One of the series was fired in an oxidizing atmosphere and in consequence was yellow in color, while the second series was fired in a reducing atmosphere and was white in color. The resistance to crushing was determined at different temperatures up to 1500 deg. Cent. by special methods available at the laboratory. Of each grade of material three samples were tested, and the results averaged, and converted into English measures, are given in the following table:

Temperature, Deg. Fahr.	Breaking Strength, Lb. per Sq. In.	
	Yellow Samples	White Samples
59	37,683	32,521
2012	9,456	7,437
2192	4,233	2,915
2372	2,702	2,076
2552	384	213
2732	0	0

The crushing at ordinary temperatures was effected in the hydraulic press. Between the ordinary temperature and 2012 deg. Fahr. it was not possible to break the cylinders, the pressure required being beyond the capacity of the press used. At 2732 deg. Fahr. the material is completely melted.

Tests for dielectric strength were made at the Central Electrical Laboratory of Paris. In this case cylinders about 3 in. long and 1¼ in. in diameter were used. There was an axial hole about ⅜ in. in diameter at one end of the cylinder, of varying depth, so as to leave a bottom of different thicknesses, according to the type of the sample.

Some of the samples were glazed on the cylindrical surface and head.

Tests were made to determine the dielectric strength for different thicknesses of insulating material, both when dry and after immersion for 24 hours in water at atmospheric temperature. In making the tests, each cylinder, submerged entirely in oil, rested with its base on a metal plate which was connected with one terminal of a transformer, the other terminal of which was put in mercury at the bottom of the hole in the cylinder. Electric pressure was applied to an initial voltage of 20,000 and was then gradually raised in steps of 1000 volts.

With cylinders of 4 mm. thickness at the bottom, unglazed cylinders not submerged in water punctured at 60,000 volts, and two glazed cylinders punctured at 50,000 and 60,000 volts respectively. Cylinders having been submerged in water for 24 hours punctured at exactly the same pressures as the dry ones. On the strength of the above figures it is claimed by the manufacturers that the dielectric strength of Isolantite is 75 per cent greater than that of wet process electrical porcelain.

Income Tax Procedure

INCOME Tax procedure is a mystery to almost all persons who are not connected in some way with the legal profession, and for that reason it is advantageous to know of a reliable source from which accurate information may be obtained. Such a source is the 1922 edition of "Income Tax Procedure" by Robert H. Montgomery, C.P.A., published by the Ronald Press Co.

While dealing with the new Income Tax Law in detail this book includes Matter on the Federal Capital Stock Tax, Federal Estate Tax and a supplement to excess profits tax procedure of 1921. Two valuable features of this book which should be mentioned, are: The policy of quoting exactly from law and regulations all material of importance in the preparation of returns, and, the including in footnotes facts concerning former law and procedure, this latter serving to help in the solution of problems arising over old returns.

New Durant Product Makes Good Impression

Star car compares favorably in design with cars selling in next higher price class. Parallels Ford in prices of all body models. Has 102 in. wheelbase, pump circulation, long, semi-elliptic springs, conventional gearset, storage battery and several other features usually found in higher priced cars.

By Herbert Chase

WASHINGTON, March 9, 1922.

DURANT and his engineers, collaborating with a number of parts makers, appear to have done the thing which many have thought possible but few have seriously attempted, the production of a car of conventional type and free from certain types of construction peculiar to the Ford product, but intended to sell at a price the same as that of the Ford in all body models. This car, to be known as the Star, was shown here publicly for the first time, to-day, and proved to be the center of intense interest on the part of the public as well as many men prominent in the automotive industry.

Expected to Heighten Competition

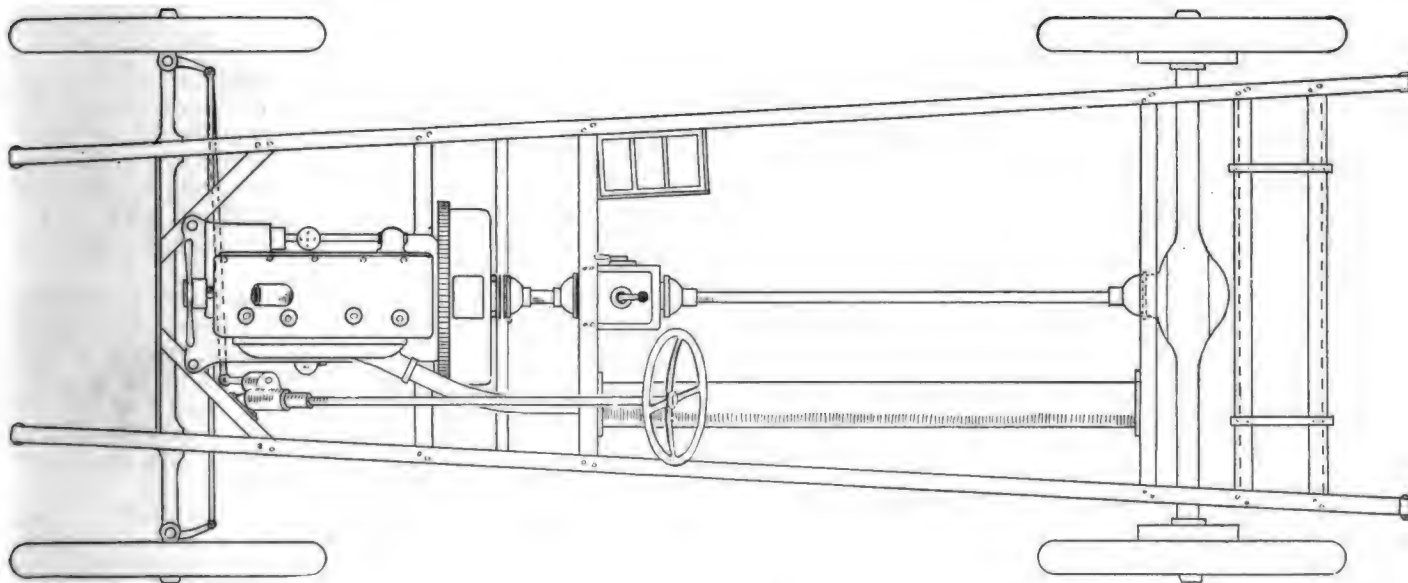
The new product compares favorably in design with that of concerns which have heretofore come close to Ford in the price of their cars but sells, when equipped with demountable rims and starters, for about \$100 less than the least expensive of well-established makes, other than Ford, now on the market. Just what this will mean, especially to Ford and his nearest competitors in the price scale, remains to be seen, but if the move proves to be all that it appears to be on the surface and is carried through in respect to sales and service in a manner similar to that which has proved so successful with Ford, there seems to be little reason to doubt that it

will heighten competition and prove to be a large factor in the automotive trade of the country.

The Star Company for whom Durant will make the car on contract has not yet been incorporated. Those in a position to know are emphatic in their statement that the various parts makers will not be stockholders, a statement which is borne out by representatives of parts manufacturers who came here to see the new car and learn more regarding plans for its manufacture, and sale. Sales plans are not yet worked out, but it was learned on good authority that the intention is to follow closely Ford's marketing policy. There will not, in any case, be exclusive territorial allotments, and there will, as with Ford, be as many agencies in each town as the trade warrants.

Most Units New in Design

The car is not, as some assumed, wholly an assembly of existing parts. Most of the units are quite new in design, but a few are now used in existing cars. The design is not the product of any one engineering organization. It has been worked out by Durant engineers in co-operation with the engineers of the various parts companies interested in supplying the various units. On this account the components of each unit are already standardized and in use to a certain extent, but other parts have been specially designed to meet the particular con-



Diagrammatic sketch showing approximate layout of the chassis of the new Star car. Side rails and all cross members save that under rear end of engine are straight

dition so that the units as assembled are not in most cases duplicates of units used in other cars, though they are mostly of conventional design and are so laid out as to facilitate ready production with existing tool equipment wherever possible.

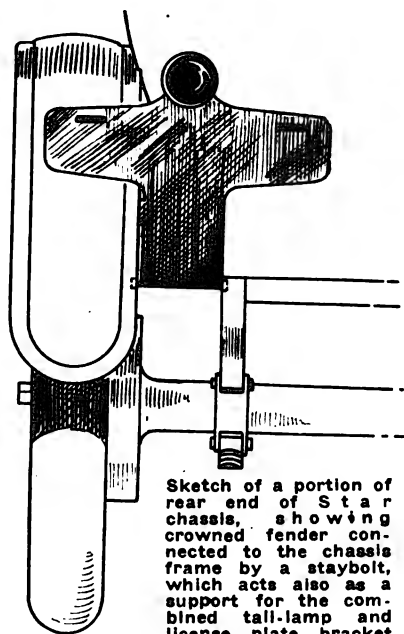
In general the design is quite similar to that of the Durant Four, being characterized by the use of a tubular frame member, which serves as a muffler, but is primarily intended to prevent twisting of the frame with consequent body weaving, and the employment of a separately mounted gearset located amidship, instead of the unit power plant used by Ford and nearly all other American car manufacturers. This construction adds certain parts, but has material advantage in the way of added accessibility, especially in respect to the clutch.

The longer wheelbase and wider frame enable the use of a body which is not unduly cramped and is reasonably comfortable, while the body lines are modern and as pleasing as those of most cars in the low-price class.

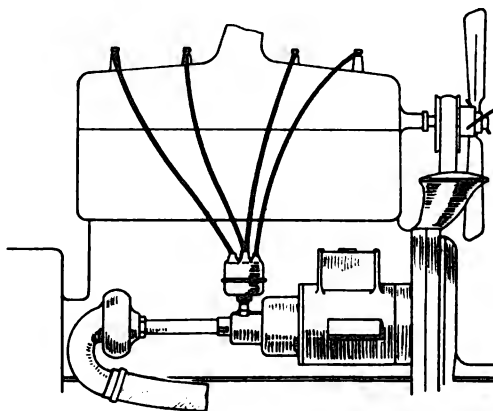
understand that each parts maker was given a certain limit in respect to price and the space available and told to offer the best he could within these limits. The result is highly commendable and one which could probably not be duplicated in any other country and perhaps not in any other industry, save the close-knit and progressive automotive industry.

Durant plans to begin production of the new car about June 1 at the rate of about 50 cars per day, this rate to be increased to 500 per day as rapidly as possible. It is expected to reach 1000 or more per day in 1923. Parts makers are tentatively working upon plans which call for units for 500 cars per day by Sept. 1, 1922. First deliveries are expected June 15.

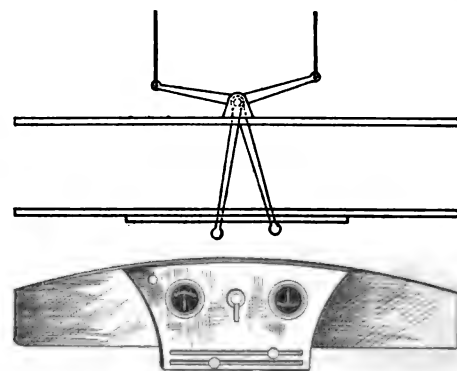
It has not yet been announced at which, if at any of the existing Durant plants the new car will be assembled, but it is probable that a portion of the Long Island City plant will be used at least temporarily for cars to be delivered in that vicinity. The prices quoted are, however,



Sketch of a portion of rear end of Star chassis, showing crowned fender connected to the chassis frame by a staybolt, which acts also as a support for the combined tail-lamp and license plate bracket



Sketch showing general arrangement of the chain-driven Auto Life generator and ignition unit, and the water pump, which is at rear end of cylinder block



Sketch showing approximate layout of instrument board. The spark and throttle levers are bell-cranks which project through the dash and are connected by rods to timer and carburetor

The long semi-elliptic springs should also make it easier riding. The lamp equipment and arrangement appears to be as good as that on many higher priced cars, and the battery, which is furnished even when the starter is not sold also, provides current for lights whether or not the engine is running. Modern ignition and lubricating systems are also supplied and other features are quite up to date.

It will thus be seen that the design has not been skimmed by confining it to the use of bare necessities. Cheaper construction could have been used in several instances, had this been considered desirable, but probably not without sacrificing some desirable quality or feature considered well worth the added expense. This does not mean that certain changes and refinements, or perhaps some simplification will not in time be made, but it does mean, if present promises are fulfilled, that the public will be offered a thoroughly modern car at a price as low as that of the cheapest car of to-day.

How Design Was Developed

The product here discussed is especially remarkable in that it was, we are told, designed and built in less than one month's time. This has, of course, been due partly to extraordinary co-operation among the various parts makers and in part to an unusual conception and execution of a plan worked out by Durant engineers. We

"plus freight from Detroit" as in the case of Ford sales.

The new car, it is understood, will not in any way interfere with the manufacture of other Durant products, which are to be continued according to schedule.

Engineering Features

The Star car presents an interesting engineering study, although it follows conventional lines in most respects. The construction is entirely different in many particulars from that employed by Ford. In a number of ways the chassis layout and many details resemble those of the four-cylinder Durant car, which might be expected since both cars were in large part designed by the same engineers.

It should be understood that, while the component parts of the car are made by various makers of standard parts, they have in nearly all instances been specially designed for use in the Star. The engine is, for example, a design laid out jointly by engineers of the Durant and Continental companies, but necessarily retains many parts similar to, or identical with those employed in other Continental engines.

The engine is of conventional L-head construction, with cylinders and crankcase cast in a single piece to which is bolted a separate head and a lower crankcase pressed from sheet metal. The engine is described as a high speed type and is said to develop a maximum of 35

hp. at 2500 r.p.m. It is of $3\frac{1}{8}$ bore by $4\frac{1}{4}$ -in. stroke, giving a piston displacement of 130.4 cu. in. as compared to the Ford with $3\frac{3}{4}$ by 4-in., with a piston displacement of 176.7 cu. in. The engine is said to weigh about 10 lb. less than that used in the Ford, but, because of its higher speed, to have considerably more power. It differs from the Ford engine in a number of other particulars, the most important of these being the use of a chain instead of gears for driving the camshaft and the combined lighting generator and ignition units, and in the use of a pump instead of thermo-syphon circulation. The pump as now arranged is located near the rear end of the engine and is driven off an extension of the generator shaft. The chain is arranged in a triangular layout and is enclosed by a cover of sheet metal.

Carbureting and Electrical Equipment

Besides the spark plug holes there are, in the head over each cylinder, holes tapped with $\frac{1}{8}$ -in. pipe thread in which priming cocks can be inserted, but the engine shown was not supplied with the cocks. The inlet and exhaust manifolds are cast with one common wall which serves as a hot spot to heat the incoming charge. The carbureter is of Tillotson make and is fed from a Stewart-Warner vacuum tank which draws fuel from the main tank located at the rear of the frame. A hot air stove with short pipe connecting with the carbureter inlet is also used.

The Auto-Lite lighting generator and ignition unit are located at the right side of the engine just back of the chain case. The cutout is placed on the side of the generator and the coil on the top of this unit, while the distributor, which comes about opposite the center of the engine, is on a short, vertical shaft. With this location, short high tension wires to the plugs can be used. A combined oil filler and breather pipe is mounted on the chain case, just above the lighting generator.

The car shown had no starting motor, but the flywheel is toothed to mesh with the conventional pinion with Bendix drive when the electric starter is furnished as an extra.

The oiling system employed is a combination pressure and splash type, the oil being fed under pressure through the hollow camshaft from which it flows, still under pressure, to the main bearings. The connecting rod bearings and pistons are arranged for splash lubrication.

The fan is mounted on a fitting attached to the front end of the cylinder casting and is driven direct by belt from a pulley on the crankshaft. The fan is adjustable vertically to provide for taking up a slack belt.

The combined inlet and exhaust manifolds are located on the left side of the engine. The latter has a four-point suspension, the rear end resting on a channel-section cross member, which is bent downward at the

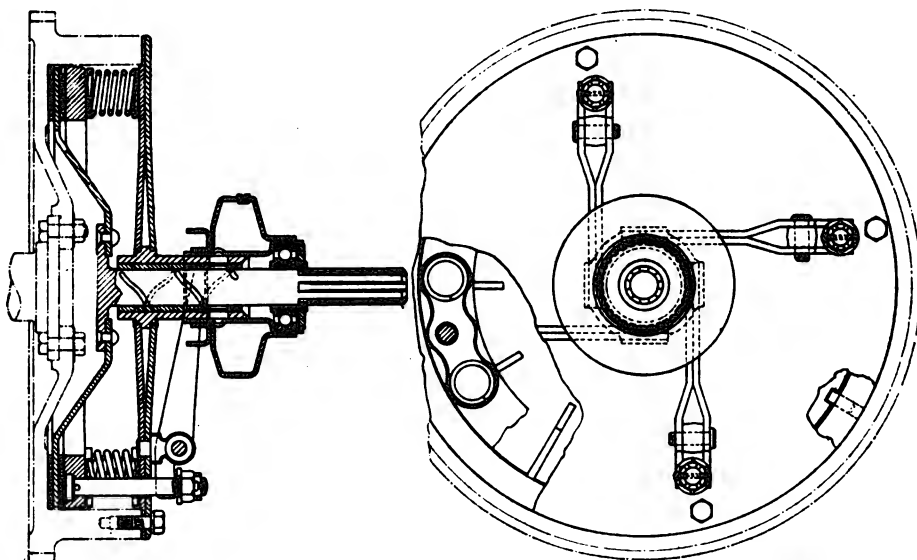
*We are told that no complete drawings of the Star car have yet been made, and that because of the speed at which the car has been assembled, certain details will be changed, for which reason detailed photographs cannot yet be furnished. On this account and because of the crowd around the car the time it was placed on exhibition the drawing here reproduced had to be worked up from rough sketches made on the spot. The drawings are in part diagrammatic and not intended to show details of construction so much as to give a better picture of the type of construction employed than would otherwise be possible.

center to pass under the crankcase, and the forward end on the diagonal channels which run from the main side member of the frame to the front cross member.

Clutch and Gearset

The clutch is of the single plate type and is practically identical in general design to that used in the Durant four-cylinder car. The spindle of the light driven member is carried in a sleeve supported from a flange bolted to the rim of the flywheel. This flange, together with the flywheel, completely encloses the clutch, and to the flange are pivoted the disengaging levers which move the pressure ring against the action of the springs which bear directly upon it. Two molded rings of asbestos composition form the clutch facings which float on each side of the driven member. The facings are thus pressed between the face of the flywheel and the thrust ring. The driven plate is thin and is slotted radially at a number of points to prevent heat distortion.

The annular type throwout bearing is enclosed in a

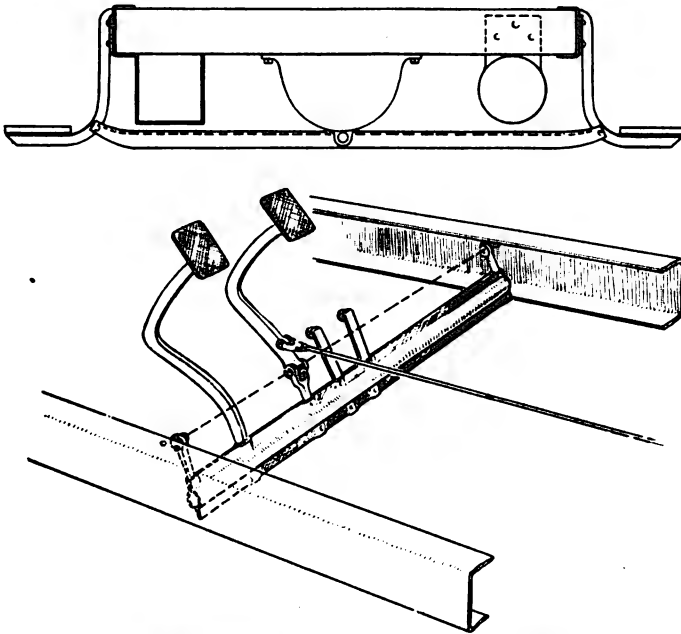


Clutch used on the Durant Four. The clutch employed on the Star is substantially a duplicate except as to a possible variation in number of springs employed

pressed metal case filled with oil. This oil serves to lubricate the clutch spindle as well as the throwout bearing.

The clutch is operated by a pedal attached to a tubular member which, as shown in one of the accompanying cuts,* runs across the frame under the clutch spindle. This tubular member is carried at each end in trunnions which enable it to swing through a short arc, as the clutch pedal is depressed. A yoke at the center of the tubular member engages the throwout flange of the clutch. The tubular member also serves to carry the pivot for the brake pedal, the axis of this pivot being in line with the axes of the trunnions, which carry the tubular member. For this reason the action of the foot brake is entirely independent of the clutch, although both pedals are supported by the same member.

It has not yet been announced who will manufacture the gearset and the clutch, but the former is to be of conventional type with three forward speeds and reverse. The shaft and gears employed will be similar to those used in other light cars, such as the Chevrolet "490," but the case will be made to conform to the separate mounting on cross members, as shown in the accompanying sketch. The case is bolted to the lower flange of a straight channel cross member, and rests below on an angle iron attached to the running board supports, which are in turn attached to the outside of the main



Sketches showing, above, an approximate sectional view of the chassis just forward of the separate amid-ship gearset which is bolted to a channel above and an angle below, the latter being attached to the running board hangers. Location of the battery and combined muffler and frame member is also indicated. The lower view shows diagrammatically the tubular member which is carried in trunnions attached to the main frame. This member is made from two stampings and serves to carry the brake pedal and the clutch pedal and throwout yoke

frame channels. The gearset is operated by a central control arm in the conventional manner. The gearset cover carries also the hand brake lever.

Rear Axle, Springs and Frame

The rear axle is of conventional semi-floating banjo type and is to be built by the Timken company. It is fitted with a spiral bevel gear, giving a $4\frac{2}{3}$ to 1 reduction and carries 10-in. brake drums with internal hand brakes and external foot brakes. The wheels and differential are carried on Timken bearings. A rear cover plate permits ready access to the differential, which can be removed through the rear opening.

The rear springs are of semi-elliptic type and are of unusual length for a light inexpensive car. They have six leaves, $1\frac{1}{4}$ in. wide and measure 48 in. in length. They are underslung from the axle to which they are held by U-shaped spring bolts. The springs are located directly under the frame and are pivoted at their front ends on pins carried between triangular plates riveted to the frame. The rear ends of the springs are carried by long shackles pivoted on the rear horns of the frame. These shackles are stamped from heavy sheet metal formed into an H-section, the central portion acting to hold the side link members parallel. This shackle is similar to that used on Durant cars, except that it is somewhat longer.

The front axle is a Timken product of the usual I-beam construction and has Timken bearings for the wheels. It supports semi-elliptic springs, which measure $1\frac{3}{4}$ by 34 in. The tie rod is in back of the axle and is just below the drag link, which is connected transversely from the right steering knuckle to the steering arm on the left side of the car.

Wheels are of wood and carry 30 x $3\frac{1}{2}$ -in. tires all around.

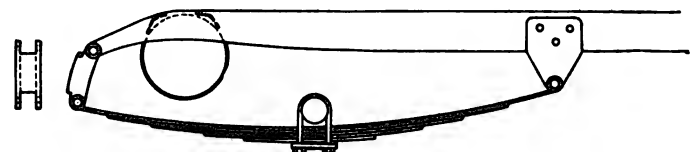
In general construction the frame is very similar to that employed in the other Durant cars. It is characterized by the use of a long tubular member, which is rigid-

ly connected to the cross member in front of the gearset and to the main rear cross-member, which is almost over the axle. This gives the frame unusual rigidity against twisting strains for the tube is of a large diameter and is formed of steel about $\frac{3}{32}$ in. thick. It serves also as a muffler. The side members of the frame are made of channel 4 in. deep by $1\frac{1}{2}$ -in. flange and are straight, except for the horns formed at the front and rear ends. No kick-up is provided at the rear. All other members of the frame are also straight with the exception of that which supports the rear end of the engine. The fuel tank, which is cylindrical, is carried between the two rearmost cross members. The latter are angle stampings formed approximately to fit the contour of the fuel tank, which is hung from straps which pass over these members.

Narrow diagonal channels are rivetted to the front and side members at the front end of the frame. They not only support the front end of the engine, but that at the left supports also the housing of the steering gear. The latter is of the worm and wheel type with the shaft of the wheel inclined with its lower ends slightly further forward than the upper end. To the lower end of the wheel shaft is attached an arm, which in turn carries the left end of the transverse drag link. The steering wheel is similar to that in general use, but carries only the horn button at its center. The spark and throttle control levers are bell-cranks pivoted on a bracket in front of the dash. The long arms of these cranks project through the dash and terminate in knobs which slide in slots formed at the under edge of the instrument board. The latter is of sheet metal and carries in a central panel an oil gage, ignition and lighting switch and an ammeter, as well as the handle for the carburetor choke. The throttle is inter-connected with an accelerator.

The fenders have a slight crown and are well supported at the front by a tie-rod, which carries the headlamps. The latter are adjustable for tilting. The rear fenders are attached to the frame by short stay bolts, one of which carries a combination license plate and tail lamp bracket.

The rims regularly furnished are not detachable, but five detachable rims and starter are provided at an ex-



Diagrammatic view of rear end of chassis frame showing long underslung semi-elliptic spring arranged for Hotchkiss drive, H-shaped shackle, and cylindrical gasoline tank mounted between two angle members from which it is supported by straps

tra charge, which includes also a carrier for the extra rim, the latter being attached to the rear of the chassis.

The wheelbase of the chassis is 102 in. The chassis is arranged to carry the various types of passenger or a light commercial body. It is not expected that an extended chassis, with heavier rear axle for commercial use, will be furnished, as is the practice with Ford.

The equipment of the car includes a U. S. L. battery which, of course, is arranged to provide lights when the engine is not in operation. The battery furnished, when no starting motor is supplied, may be somewhat smaller than that furnished for use in cars equipped with a starter, although this point is not yet definitely decided.

It is claimed that the car is capable of traveling 30 to 35 miles per gal. of fuel. It is said to weigh 1800 lb.

Sperry Compound Diesel Engine

Uses two stage compression of the air and solid injection of the fuel. The transfer valve between the high and low pressure cylinders and the air inlet valve to the high pressure cylinder are mounted concentrically to insure cooling of the former. An increase in fuel economy is claimed.

SOME information regarding the development work on Diesel engines done by Elmer A. Sperry has been given in former issues of AUTOMOTIVE INDUSTRIES, as Mr. Sperry has been pursuing this line of work for the past twelve years and has on several occasions spoken of it in discussions before the S. A. E. The engine has now reached a production stage, and further particulars have been furnished in recent papers before the American Society of Mechanical Engineers and the S.A.E. Motor Boat meeting, on which papers the following article is based.

Diesel himself worked out a compound type of engine working on his cycle, but it proved a failure. Two or three isolated attempts to compound the Diesel engine were made later on by others in both Germany and England, but these too petered out. Sperry took out a patent on a compound engine as long ago as Dec. 10, 1892. Of late the development work has been carried on energetically, one experimental model having followed another, until the essential problems are believed to have been fully solved.

Sperry's contention is that the simple engine of the Diesel type must necessarily be excessively heavy, because the cylinders, pistons and connecting rods have to be built sufficiently strong to withstand the enormous initial pressures of the power stroke, but because these pressures are maintained only for a very small fraction of the stroke, the parts of great weight and strength are poorly utilized. By allowing the expansion to occur in two successive stages, the high pressure cylinder, which must be very strong, can be made quite small, so that its weight will not be very great, and the low pressure cylinder and its accompanying parts, which must be large, can be made relatively light.

Indicator Cards

Consider the Diesel indicator card Fig. 1. Draw the vertical line XY, and it is easy to see that the expansion pressures to the left are high, whereas those to the right, especially following the dotted extension line of expansion, are low, and could advantageously do their work in a low pressure cylinder. The vertical line XY also divides the compression into two stages, low and high, the latter taking place in the combustion cylinder proper as a second stage. No air compressor for pressures of 500 lb. per sq. in. accomplishes its work in a single stage; there are at least two stages. The old single stage compressor has been discarded and replaced by the modern two stage compressor.

Supercharging or compressing in two stages also has the advantage that the temperature range of each compression chamber is greatly reduced. In the simple Diesel, as the compression ratio is in the neighborhood of 15:1, the compression space approximates a very flat cylinder which has a very large surface area in proportion to its volume. By referring to the sectional view of the engine and taking account of the fact that the upper end of the piston stroke substantially coincides with the plane of

the joint between the cylinder block and the head casting, it will be seen that the compression space in the Sperry engine is hemispherical in the main, but also includes a passage to the inlet and transfer valve at one side. From the standpoint of ratio of surface area to volume this compression space is certainly a good deal better than that of the standard Diesel engine.

No Air Compressor for Fuel Injection

One of the difficulties with the standard Diesel, which is especially bothersome when it is attempted to build engines of this type in small units, is the need for an air compressor for compressing the air used for injecting the fuel. Pressures of nearly 1000 lb. per sq. in. are used, and the compression is usually effected in three or four stages. This compressor not only adds greatly to the

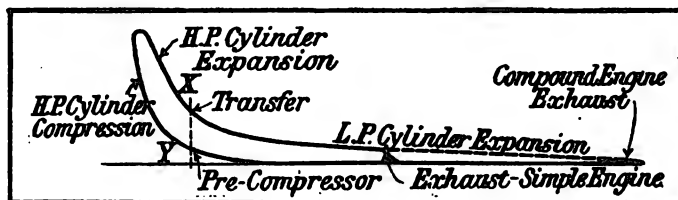


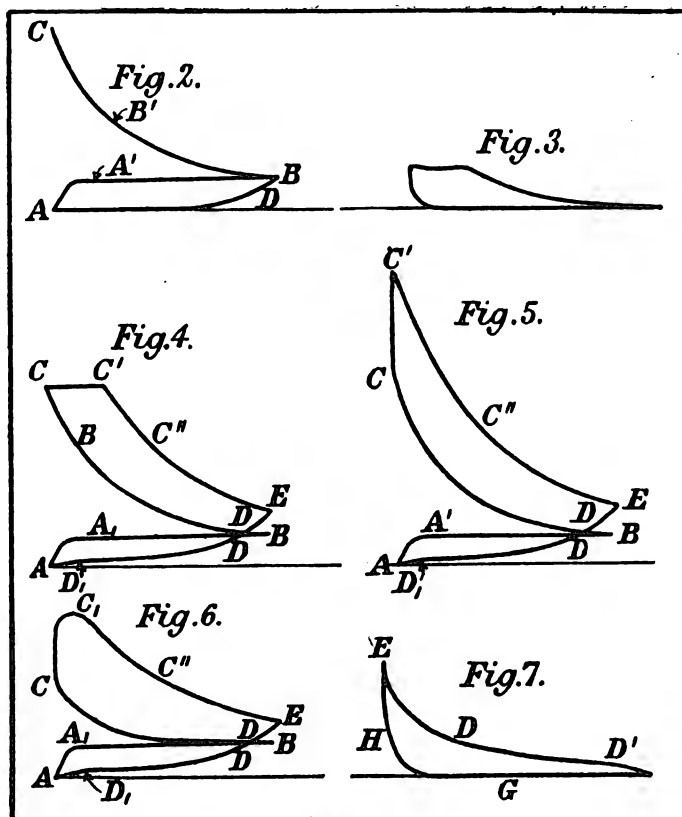
Fig. 1

weight and complication of the engine, but also materially reduces its mechanical efficiency. Vickers in England has dispensed with compressed air injection and uses instead what is known as solid injection, the fuel being forced into the compression space in a solid stream by piston pressure. It is claimed by the champions of air injection that much cleaner combustion is obtained where that method is used, but the fact that Vickers engines are installed in many motor ships shows that the solid injection principle is practical at least.

Sperry uses the solid injection principle, and claims that, since the compression space is not shallow as in the simple Diesel engine, the injected fuel has to pass through a bulky mass of highly heated air before it can strike a wall, so that the difficulty resulting from the fuel stream coming in contact with relatively cool walls, which has been experienced with simple Diesel engines using solid injection, is eliminated in his engine.

Six-to-One Ratio of Piston Areas

In his A. S. M. E. paper Sperry says that instead of expansion ratios of 3 or 4 to 1, as in the automobile engine, and about 12 to 1 in the Diesel, the expansion ratio in his engine can be made as high as 120 to 1. In an automobile engine the pressure in the working cylinder at the moment the exhaust valve opens, if the engine is operating under full load, is between 50 and 70 lb. per sq. in., and in a simple Diesel engine it is about the same. A gain in power and efficiency evidently would be reached if the charge were further expanded to such a pressure



Figs. 2-7

that the excess pressure of the gases on the piston head over the pressure of the atmosphere against the bottom of the piston were just equal to the mechanical friction of the engine.

A weak point in all compound engines is the dead space in the low pressure cylinder or the passage between the high and low pressure cylinders. This dead space allows the gases coming from the high pressure cylinder to expand before they do any work on the low pressure piston, and, therefore, constitutes a source of loss. Sperry shapes the compression space of his high pressure cylinder so that it extends partly over the low pressure cylinder and is cut off from the low pressure cylinder by the transfer valve, which makes for a small dead space. He has, moreover, hit upon another means of practically eliminating clearance losses.

The Compound Cycle

Fig. 2 shows the cycle card without fuel, taken from a high pressure cylinder of a 10 to 1 compound engine, that is, an engine with a low pressure piston having 10 times the area of the high pressure piston head. The air, after having been pre-compressed, enters the cylinder at A on the outstroke of the piston, at a pressure of about 113 lb. per sq. in., giving a pressure line A'. At point B the inlet valve closes, and during the instroke the compression proper starts and rises along B' to Diesel values at point C. There being no fuel injection, the receding stroke brings the pressure down on practically the same line B' to point B. Here the transfer valve opens, and the gases pass during the instroke to the low pressure cylinder as shown by line D. This is the outstroke of the low pressure piston, the pressure dropping to a trifle below atmosphere before the exhaust valve opens. The valve remains open during the whole of the next stroke of the low pressure piston. This cannot be shown on the high pressure card, but is brought out on the low pressure card Fig. 7.

Fig. 3 is the air pump card, representing the first stage of the compression, which delivers the air to a small re-

ceiver, from which it passes during the inlet stroke along line A' of Fig. 2. This is virtually a power stroke, and thus some of the power lost in the first stage compression is recovered here.

Fig. 4 is the same as Fig. 2, except that fuel has been injected, and shows the slow combustion of the regular Diesel cycle, common to all early cards of these compound engines, where from point C a perfectly level line is often drawn to point C', which marks the point of cut-off. The gases then expand on line C'' to point E, where the transfer valve opens and the gases continue their work of expansion on the low pressure piston, as indicated by line D. When the exhaust valve opens, at point D, the pressure within the low pressure cylinder is only slightly above atmosphere. An objection to the simple Diesel engine is that heat is added to the charge after the piston has moved away from the top dead center position and is approaching the point of exhaust opening.

Operates as Constant Volume Engine

Mr. Sperry states that a research extending over a year and a half led to the discovery of a method by which detonation can be invariably secured. He does not say what this method consists in, but it is obvious that if the fuel were injected during the compression stroke before the temperature of the air became sufficiently high to ignite it immediately upon its entry, then detonation would result as soon as the air temperature reached the ignition value. In an English report on researches on Diesel engines carried out during the war, the statement is made that detonation was encountered which at times was rather distressing, and that it was very desirable to eliminate this detonation, but that it could not be done without at the same time lowering the fuel efficiency. Sperry, however, claims to have found that the thermodynamic efficiency is higher in the case of high detonation diagrams than in most of ordinary ones, and he has therefore sought to "harness and utilize" to the full the detonation phenomena which are such a bugbear to the automotive engineer.

Fig. 5 is a typical card taken under the same conditions and from the same engine as Figs. 2 and 4, exhibiting "detonation." When operating in this way the engine also gives a very much truer Carnot-cycle card. All recent running of the compound engines has been in accordance with this card. One of the achievements of high-intensity

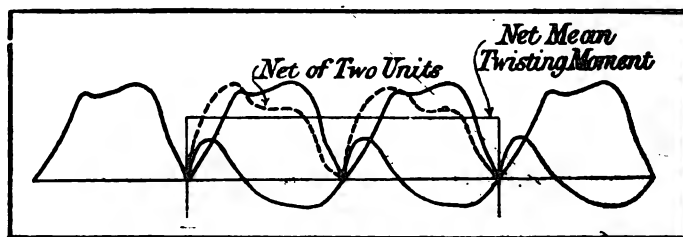
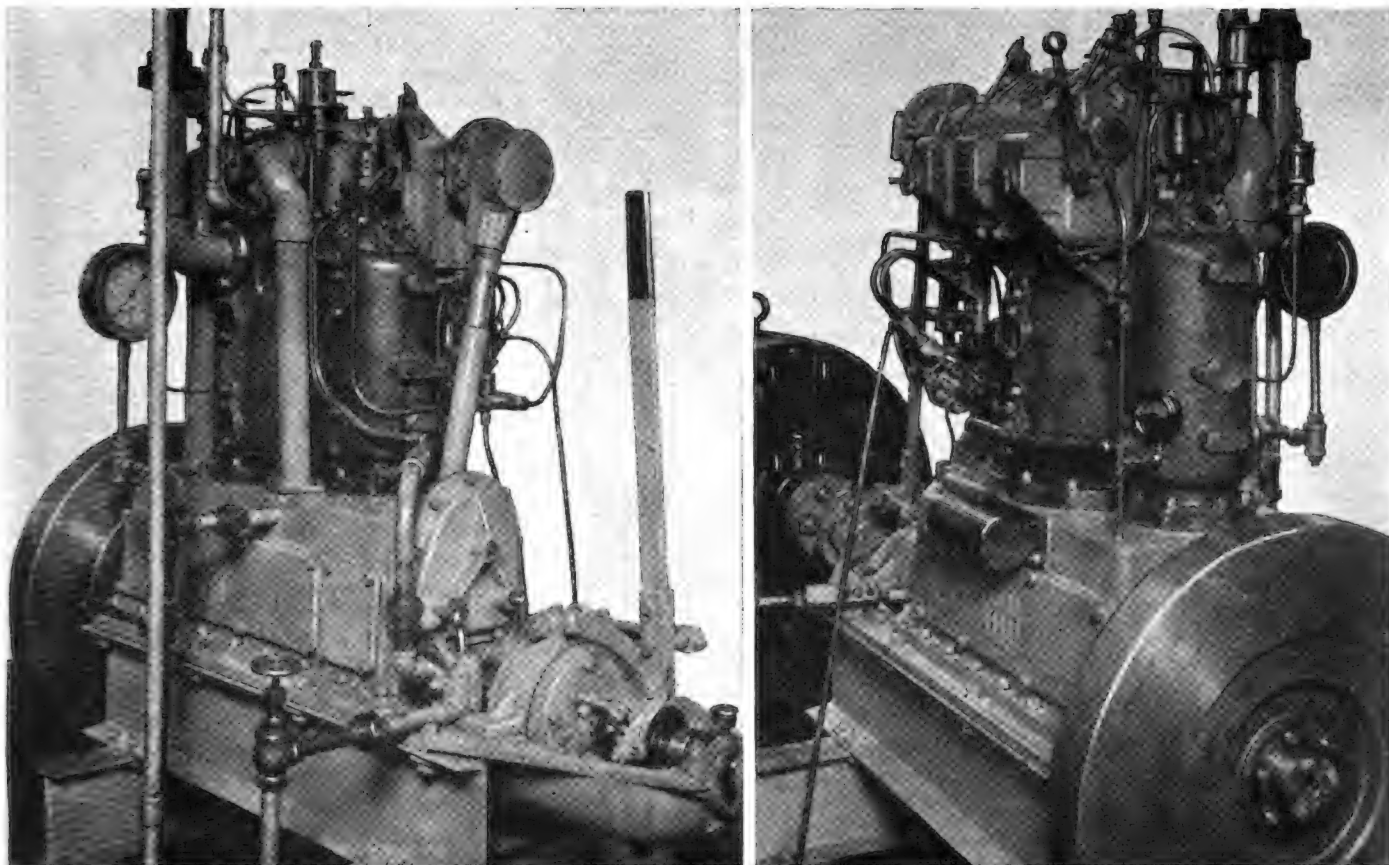


Fig. 8

combustion is better thermal efficiency and a still further reduction in the exhaust temperatures. The engine with this type of card is changed from a constant pressure to a constant volume cycle engine, which change is claimed to free it from all speed limitations. The detonation characteristics, e.g., the vertical rise on the diagram, persist even at very high speeds. This card also insures operation at lower fractional powers without indication of carbon deposits. Fig. 6 is given as showing the range of control of the peak and shape of the card at will under the same operating conditions and with the same spray nozzle. Referring to Figs. 5 and 6, the peak pressures given by these cards may seem high, but they are said to



Two views of Sperry compound Diesel engine for marine use

be not as high as the pressure often encountered in the cylinders of gasoline engines, and the factors of safety provided easily take care of the stresses caused by these pressures.

Avoiding Transfer Losses

A complete solution of the problem of avoiding losses due to the low pressure cylinder clearance is said to have been found in a modification of the process of cushioning—closing the exhaust valve at a pre-determined point before the outstroke end, trapping a little of the hot gases and cushioning them up to the transfer pressure so the transfer valve opens under conditions of equal pressure on each side. There is, therefore, no flow of gases except that due to the slow starting of the strokes of the two pistons. There are practically no losses sustained in cushioning; the power of compression is returned very completely on expansion. Cushioning is credited with the additional advantages of preventing all erosion due to high velocities of the hot gases over the transfer valve seats. These seats are jacketed and are said to remain smooth, bright and perfectly sealed over long periods.

Compounding is said to completely suppress all pre-ignition, because the first part of the compression occurs outside the combustion chamber and the work of the Bureau of Standards has shown that the pre-ignition must occur early in the compression stroke in order to cause really dangerous pressures. No safety valves or pressure relief valves are therefore required or fitted.

The Transfer Valve

The transfer valve, considered as an exhaust valve, is here called upon to handle much hotter gases than ever before. A difficult situation is therefore presented. Are special materials necessary and how can the valve successfully perform this duty? It is known that the exhaust valves of the Liberty motor run red hot, and the stems

white hot, and yet they are handling gases of lower temperature than are here present. Mercury cooled valves were originally provided and have now stood on the shelf unused for some years, as neither of these expedients is found necessary, nor are any but ordinary materials required. It must be remembered that compression in the compound engine is by the two-stage method. Air is admitted to the combustion chamber under comparatively high pressure, and although it is warm, yet with each doubling in pressure its cooling powers are doubled. Air at 100 lb. per sq. in. thus has seven times the cooling power of atmospheric air, as seven times the number of molecules come in contact with the valve for cooling in a given time. The part through which the air enters the high pressure cylinder is in line with the transfer port, and the induction valve itself rides on the back of the transfer valve in the form of a hollow sleeve *I* (Fig. 9) seated directly on the top of the transfer valve *T*. The back of the transfer valve is provided with greatly enlarged radiating and cooling surfaces presented to this cooling air, and powerful convection currents are constantly acting when sealed.

Now in following out the cycle it will be noticed that this is the very step that follows directly on the heels of the transfer of the hot gases (*D*, Fig. 2) and continues throughout the next quarter cycle (see *A'*, Fig. 2), and through the entire descent of the high compression piston. The transfer valve is intensely heated on its under side during the transfer stroke, but it is also intensely cooled on its upper side, which has a surface area five times as great, and the result is said to be that the mean temperature of the valve is only about half as high as that of the Liberty engine exhaust valve, not nearly approaching red heat. The seats of these valves are said to give no trouble, because they are backed by ample water jackets. They need to be ground in only very rarely.

As to the proper ratio for compounds, engines of 10:1

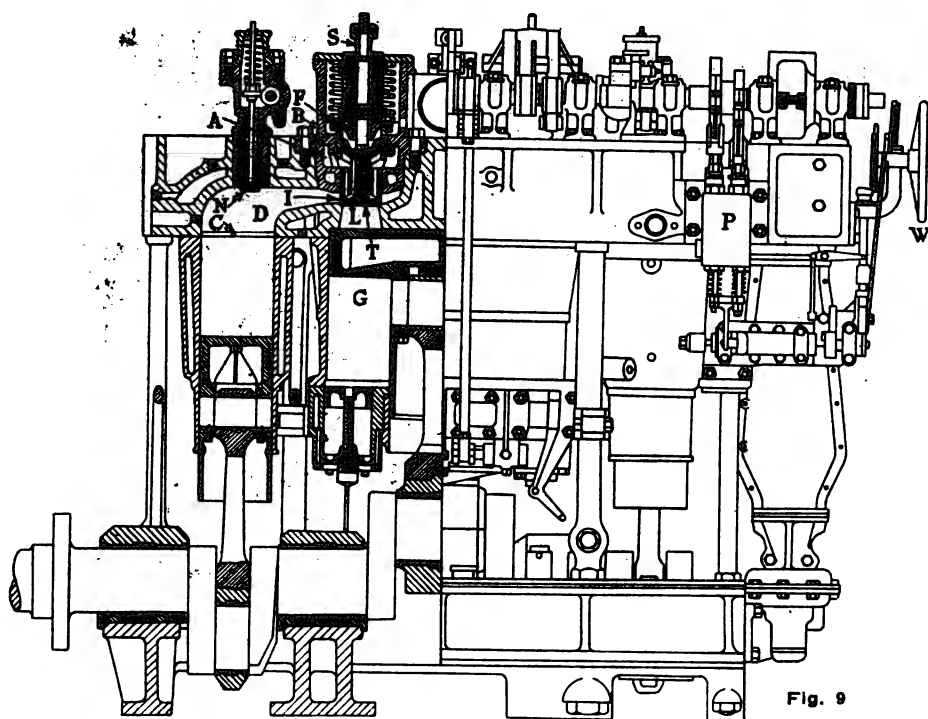


Fig. 9

ratio of low-pressure to high-pressure cylinder areas, also 8:1 and 6:1 have been made, operated and studied, the smaller ratios being at present considered more desirable. The weight factor does not change materially with changes in ratio in this region. The low-pressure piston operates two-cycle. The power distribution and the weight of the reciprocating parts both equalize best at about 6:1. This makes a perfectly balanced unit, the end masses equalling and also moving oppositely to the central. The two full power impulses following each fuel injection are also about equal. Thus full four-cylinder performance is secured with only three cranks, and two extra power impulses are delivered on the induction stroke (see line A', Fig. 2) making six power impulses for each cycle.

Now as to the construction of the compound, Fig. 9 shows an elevation (to the right of the center) and longi-

tudinal section (to the left) of the engine as built. The two high-pressure or combustion pistons on their out-stroke are at the ends, and in the center is the low-pressure at its extreme in-stroke. The sturdy construction is indicated by the size of the crankshaft, approaching the bore of the combustion cylinders themselves. The fuel pumps *P* and the control and manipulating wheel *W* are shown in elevation to the right. To the left the large clearance dome *D*, forming the combustion chamber of the compound, stands out in marked contrast to standard Diesel practice, which is shown by the little space *C* between the solid horizontal line just above. The dome is large and forms an upward extension of the combustion cylinder, extending also to the right in a large sweep surrounding the transfer valve *T* which seals the transfer port *L*. The sleeve-like induction valve *I* is shown seated on top of the transfer valve and is controlled by the cam-operated fork *F*. The transfer

valve and sleeve are lifted by a fork not shown, located in thimble *S* near the top of the stem. The first stage annular compression pump *G* surrounding the trunk piston below the low-pressure piston proper delivers its air to a small receiver, which in turn discharges to the cored port *A* surrounding the induction sleeve *I*, the cooling action of which has been described. The little balancing cylinder *B* sustains a permanent connection with the low-pressure cylinder. The solid-fuel injection valve and nozzle *N* are placed approximately over the center of gravity of the large masses of air in the clearance dome *D*.

It is understood that the two high-pressure cylinders are operating four-cycle, one 360 deg. back of the other, discharging alternately into the low-pressure, which therefore works two-cycle and delivers power on each down stroke.

The Soldier Bonus

THE following statement has been issued by Joseph H. Defrees, president of the Chamber of Commerce of the United States, with reference to the proposed certificate plan for paying the soldier bonus:

"A general bonus paid through certificates is just as objectionable, from the point of view of the Chamber of Commerce of the United States, as such a bonus paid in cash. The organizations participating in the national chamber's referendum, which closed on Feb. 21, were as unmistakable in their opposition to a certificate plan as to a cash plan. They cast 1221 votes against a general bonus in either form and only 467 votes in favor.

"The chamber's opposition is to a general bonus, however paid. The chamber has not opposed a bonus merely on account of the amount of money that is involved. Attention has been called to the money requirements because of their importance and the financial problems and consequences they entail.

"Some features of the certificate plan now under consideration by the House Committee on Ways and Means are even more objectionable than the original bonus bill.

It is proposed that certificates should be used as collateral for loans at banks and such loans should be rediscounted at the Federal Reserve Banks. Such a purpose means return to war conditions under which the reserve banks held large amounts of loans secured by Government war obligations. One of the problems of readjustment has been to get this paper out of the reserve banks and other paper of similar kind out of other banks. Great progress has been made, but this progress will be undone by the new proposal.

"Loans of this character have no place in the commercial banking system. They found their entry only in a war emergency. No loans should go into the Federal reserve system except such as are speedily and surely self-liquidating. Violation of this principle means inevitable inflation and other evils which are sure to follow violation of sound banking principles.

"It may be expected that evil results of such a plan as has been proposed will be increased as details are announced—such details as the terms of the loans and the rate of rediscount."

A New Friction Clutch of Radical Design Developed in France

Contrary in action to the ordinary type in that the clutch is engaged by increasing foot pressure. The advantages claimed for it are: smoothness of action, absence of any drag, and ease of adjustment and gear shifting.

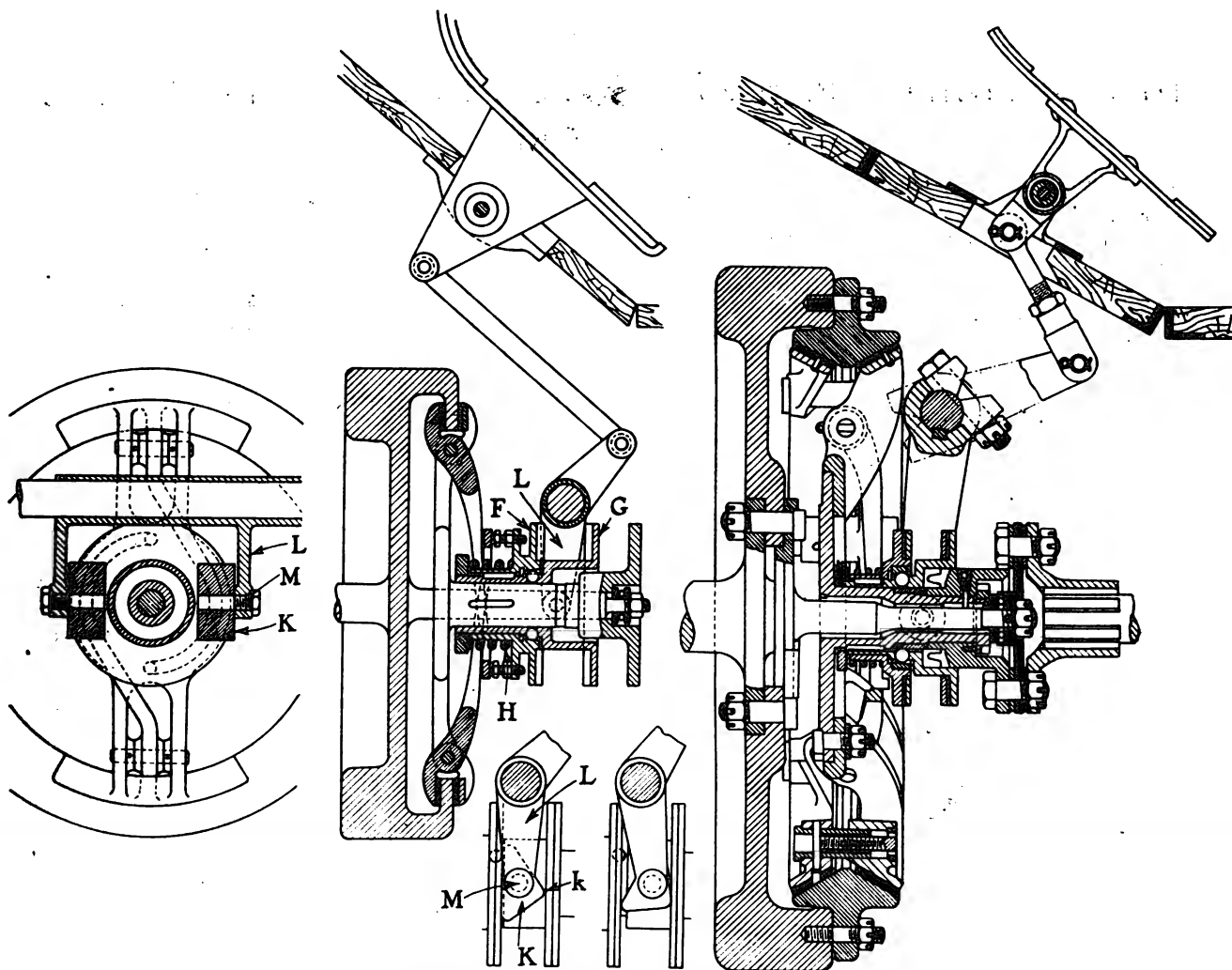
A NEW friction clutch for which remarkable softness of action is claimed has been brought from France by the Framerican Industrial Development Corp. It is known as the Baudoux clutch and the exclusive manufacturing rights have been acquired by Schneider & Cie., the well known munitions makers, who also manufacture gasoline omnibuses, mine locomotives, canal boat tractors, etc.

In the ordinary friction clutch as now used on automobiles and motor trucks, the clutch is forced into engagement by a spring. When the clutch is out, the driver compresses this spring by pressing on the clutch pedal, and when he wants the clutch to take hold he reduces his pressure on the pedal. It is much more difficult to gradually reduce the pressure of the foot acting against a strong spring, than it would be to gradually increase the pedal pressure, and it is little wonder that, especially in the case of unskilled drivers,

the clutch often takes hold by jerks or has what is called a fierce action. Soft clutches are particularly desirable in such vehicles as motor omnibuses, which start and stop continually and which, on account of their great weight, are naturally hard to accelerate.

In the Baudoux clutch, the force that engages the clutch is not that of a spring, but the direct pressure of the driver's foot on the clutch pedal. The operating action is very much like that of a brake, the degree of application of which can always be plainly felt. The clutch is being made in two forms, one a sector clutch suitable for very light vehicles, and the other a double cone clutch, which can be made in very large sizes if desired.

Referring to the illustrations of the sector type herewith, the flywheel rim is made with an inward flange which serves as one of the friction members. On the clutch pilot shaft



Cross sections of Baudoux clutch as built for light and heavy vehicles

is carried the hub of the driven member. This driven member is in the form of pincers gripping the driving flange on the flywheel. One arm of the pincers is stationary, while the other arm is pivoted on the stationary arm. The outer ends of the pincer arms form the clutch sectors which engage the flange on the flywheel rim.

The pressure of the operator's foot is transmitted to the free arms of the pincers by means of the clutch collar. It is the motion of the clutch collar toward the engine that produces engagement of the clutch. The clutch collar is positively locked in its successive positions by a locking mechanism.

The automatic locking mechanism comprises essentially two flanged sliding collars, F and G, sliding one upon the other in such manner that the distance between the two flanges is increased or decreased. The collar G, which slides directly upon the hub of the driven clutch member, is provided with a series of recesses on its circumference, in which are located steel balls. The other collar, F, has a conical counter bore bearing on the balls, by reason of the pressure exerted by the light spring H. This spring is lodged between flanges on both of the collars. Owing to the wedging action of the conical surface on the steel balls, pressing them against the hub of the clutch driven member, the sliding collars cannot recede to the right. The two sliding collars and the hub of the driven member are provided with splines, and may therefore slide longitudinally one upon the other without angular motion.

When the clutch is to be disengaged it is, of course, necessary to relieve the wedging acting on the steel balls. The release is effected by pressing simultaneously to the left on

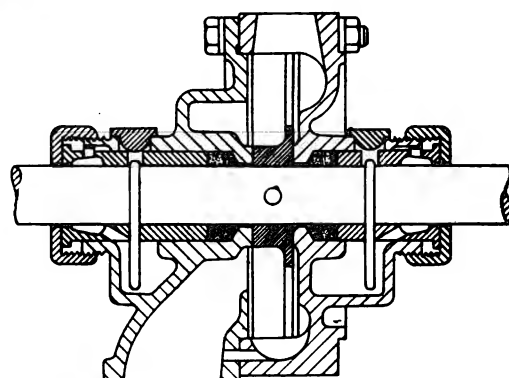
the left flange F and to the right on the right flange G. The recession of the two sliding collars releases the balls and consequently allows the assembly of collars to slide on the hub of the driven member. This result is obtained automatically by the effect of the spacer K which operates as follows: The forked lever L, which bears on the flange F for the engagement of the clutch, applies its effort through the intermediary of two triangular cams K on trunnions M. The contour of these cams is shaped to give the following result: For the clutch engaging action (right to left) the long side of the cam is forced against the left-hand flange and the opposite point is out of contact with the right hand flange. For declutching, the pressure toward the right on the trunnion M brings the point K of the cam in contact with the flange G and in consequence of the adherence of the steel balls, effects a rocking motion of the spacer K. This action on the clutch yoke therefore forces the two sliding collars apart, and since the force on the yoke is toward the right, the sliding collar assembly is withdrawn toward the right and the clutch thereby disengaged. The two flanges F and G are provided with hardened facings, and the pressure of the point of the cams is distributed over a large area. Adjustment of the clutch can be made by means of the adjusting screws plainly shown.

Among the advantages claimed for this design of clutch are great smoothness of action, due to causes already explained; absence of drag, due to the small number of parts and the precision with which adjustment can be effected, and, finally, ease of gear shifting, by reason of the small inertia of the driven member. The clutch is in use on motor omnibuses and other heavy vehicles in France.

Aro Circulating Pump with Special Packing and Means of Lubrication

THE Arrow Pump Co. has incorporated its ring oiled packing gland feature in a standardized design of circulating pump for automobiles, trucks and tractors. As may be seen from the accompanying views, the pump proper is a standard unit, and special fittings for the inlet, outlet and mounting bracket are provided to suit different installations. The pump is shown herewith ready for installation on the Paige motor.

The cross sectional view shows in detail the Arrow construction of the packing gland, with its ring oiling method of lubrication. This construction is claimed to entirely prevent leaky glands, scored and pitted shafts and worn bearings. With this method of lubrication it becomes practical to place the packing between the hot water and the bearing. The new construction is intended to prevent entrance of hot water or foreign substances into the bearing, thereby protecting bearings and shaft from destruc-



Cross section of Aro circulating pump

tive effect. It prevents the lubricant from being washed out, and confines it to the bearings, shaft and packing.



Complete pump with special fittings

An Improved Drill Chuck

A DRILL chuck with a safety feature to prevent the breaking of drills has been developed by the SaveAll Tool Co. A positive pin drives the collet and shears before drills, reamers, etc., can break or burn. Tools can be quickly changed while the machine is running or stopped. The compensating positive collet lock automatically takes up wear, eliminating end play of the collet and reducing the chances of the tool hogging into the work. One advantage claimed for this chuck is that dull tools cannot be used.

Aircraft Engine Experience as a Basis for Automobile Engine Development

Super-compression and over-dimensioning of engines as an aid to fuel economy. Its possible application to "gearless" cars. An improvement of the starting torque would make the internal combustion engine flexible. Mr. Dechamps gives the results of actual tests as well as his calculations.

By H. Dechamps

THE enormous development of aircraft during the war in all the participating countries has borne fruit in the further improvement of internal combustion engines, in that the weight and fuel consumption have been reduced and the specific output increased in entirely unexpected proportions. Although the service conditions of automobile and aircraft engines are materially different, there is so much in common between the two that it is good policy for automobile engine designers to heed the lessons of aircraft engine experience.

It is not the intention in this article to discuss details of construction, particularly in view of the fact that many of the improvements which were found absolutely necessary in aircraft engines have since been applied to automobile engines. Reference is here made to such features as the location of valves in the cylinder head, the hemispherical formation of the compression space, the complete machining of the compression space, the use of steel and aluminum in place of cast iron for cylinders, improved means for heat disposal by the use of aluminum pistons, the increase in the number of cylinders and the better balance of the moving parts.

Increasing Compression

These various improvements, the advantages of most of which can be checked by means of comparatively simple theoretical calculations, have made it possible to use a higher compression without incurring danger that the engine will knock. The favorable effect of an increase in the compression ratio on the output and fuel economy is well known. It is probably less well known that the gain is actually greater than theoretical considerations would lead one to expect. Very accurate tests on a Benz engine, whose compression ratio was increased from 5 to 5.8 by the installation of longer pistons, gave the results compiled in the following table, those for a compression ratio of 5 being placed equal to unity:

Compression ratio.....	1:5	1:5.5	1:5.65	1:5.8
Theoretical output.....	1	1.045	1.055	1.065
Actual output.....	1	1.065	1.100	1.125

This extra gain in output, beyond what would be expected from the increased pressure and temperature drop, is due to an improvement in the efficiency of combustion with increased compression, effected more rapidly, as is further attested by the fact that the gain increases rapidly at higher speeds.

Unfortunately, the permissible compression is rather closely limited by the tendency of the engine to knock and the demands as regards smooth running are much more severe in the case of automobile than that of air-

craft engines. This is not the place to go into all the different causes of knocking, but it may be pointed out that this factor is a test of the ability of the designer. Whereas some engines begin to operate roughly with a compression ratio of only 4.5, the more capable designer succeeds to force the compression up to 5.8 without the engine inclining to knock. Aside from the timing of the valves, which is of considerable influence, the cooling arrangements are determining. A chain proverbially is no stronger than its weakest link, no matter how strong the others may be. In connection with cooling the weak link is the particular point whose overheating causes pre-ignition, and whose determination and elimination is a problem for the engineer. If the rules which in the foregoing were referred to as well known are given due consideration, the weak link which causes knocking is usually the spark plug. In determining the location of the latter it is impossible to be too careful that the spark plug boss is effectively cooled by water all around, and that the walls of the boss are thin enough so as not to permit of too great heat accumulations. The selection of the spark plug also is of great importance. There is as yet no universal plug, because the plugs manufactured for engines with super compression, which have excellent heat radiation facilities, become easily sooted when the engine is idling, as under that condition the temperature of the plug insulator is too low to burn any oil that collects upon it. In connection with these very sensitive engines, more exacting demands must also be made on the workmanship, as a single passage on any cylinder boss which is clogged with core sand or iron suffices to cause steam pockets to be formed and overheating to result, and thus lessen the value of the whole engine.

Fuel Economy

In the case of commercial vehicles, where economy is imperative, it is possible to effect a considerable economy in fuel consumption by an increase in compression ratio, in combination with the use of a suitable reduction ratio between the engine and rear wheels. A departure in this direction was made by the Bayerische Motorenwerke, who are furnishing a 45-hp. truck engine with a guaranteed fuel consumption of 220 grams (0.484 lb.) per horsepower-hour, which as compared with consumptions of 300 to 350 grams (0.66 to 0.77 lb.) represents a saving of approximately 30 per cent. This result has been accomplished by forcing the compression to a particularly high point, which was rendered possible only by throttling the engine so as to keep the maximum explosion pressures and temperatures within the limit found in conventional engines.

Special interest attaches to the theoretical proof of the economy which it is possible to secure—which was first developed by Prof. Weisshaar—for the reason that it is not easy by other than mathematical reasoning to arrive at the conclusion that such advantages can be achieved by super-compression and throttling.

Let us denote by

G the weight of a cylinder charge consisting of

G_f fresh mixture and

G_r spent gases from a previous explosion,

V_h the piston displacement,

V_c the compression space,

$r = \frac{V_h - V_c}{V_c}$ the compression ratio,

p_h the maximum explosion pressure,

p_r the pressure at the end of the power stroke,

T_h the absolute maximum temperature of the explosion,

T_r the absolute temperature of the spent gases,

R the gas constant;

we then have, $G = \frac{p_h V_c}{R T_h}$

$$G_r = \frac{p_r V_c}{R T_r}$$

By subtraction,

$$G_f = G - G_r = V_c \left(\frac{p_h}{R T_h} - \frac{p_r}{R T_r} \right)$$

From the definition $r = \frac{V_h - V_c}{V_c}$

it follows that $V_c = \frac{V_h}{r-1}$

and by substituting this value we obtain

$$G_f = \frac{V_h}{r-1} \left(\frac{p_h}{R T_h} - \frac{p_r}{R T_r} \right)$$

If we apply to an engine with increased compression the same designations and add an index figure a , we obtain for this type of engine—

$$G_{fa} = \frac{V_{ha}}{r_a - 1} \left(\frac{p_h}{R T_h} - \frac{p_r}{R T_r} \right)$$

The ratio of the charges of the two engines is then

$$\frac{G_{fa}}{G_f} = \frac{V_{ha}}{V_h} \frac{r-1}{r_a-1}$$

If we assume that the mechanical efficiency as well as the efficiency of combustion of both engines are the same, we obtain for the ratio of the outputs,

$$\frac{N_a}{N} = \frac{G_{fa}}{G_f} \frac{\eta_{ta}}{\eta_t}$$

where η_t represents the thermal efficiency. By introducing the values for the degree of filling with fresh gases we obtain

$$\frac{N_a}{N} = \frac{V_{ha}}{V_h} \frac{r-1}{r_a-1} \frac{\eta_t}{\eta_{ta}}$$

If both outputs are equal we have $N_a/N = 1$ and

$$\frac{V_{ha}}{V_h} = \frac{r_a-1}{r-1} \frac{\eta_t}{\eta_{ta}}$$

from which it follows that

$$V_{ha} = V_h \frac{r_a-1}{r-1} \frac{\eta_t}{\eta_{ta}};$$

that is to say, the high compression engine must have a greater piston displacement than the one with normal compression. But in order that its output may remain the same the mean effective pressure p_{ca} must be reduced by throttling.

For equal outputs we have

$$p_o V_h = p_{ca} V_{ha}$$

and the mean effective pressure for the high compression engine, therefore, is

$$p_{ca} = \frac{p_o V_h}{V_{ha}} = p_o \frac{r-1}{r_a-1} \frac{\eta_{ta}}{\eta_t}$$

An example will more clearly bring out the relations. Let us take a four-cylinder truck engine of 4½ in. bore and 6 in. stroke, which at 1000 r.p.m. and a compression ratio of 4.5 to 1 develops 40 hp. and consumes 0.585 lb. fuel of 17,000 B.t.u. heat value per horsepower-hour.

The piston displacement is 382 cu. in.;

The compression ratio 4.5;

The thermal efficiency $\eta_t = 1 - r^{1-\gamma} = 0.41$ (assuming γ to be 1.35).

If now an engine with a compression ratio of 6 is to give the same output, since its thermal efficiency will be

$$\eta_{ta} = 1 - 6^{1-\gamma} = 0.466,$$

this must be made with a piston displacement

$$V_{ha} = V_h \frac{r_a-1}{r-1} \frac{\eta_t}{\eta_{ta}} = 382 \frac{6-1}{4.5-1} \frac{0.41}{0.466} = 480 \text{ cu. in.}$$

or about 25 per cent more.

In the same proportion the mean effective pressure must be reduced by throttling. For the conventional engine this pressure amounts to

$$p_o = \frac{40 \times 792,000}{382 \times 1,000} = 82.9 \text{ lb. per sq. in.}$$

In the high compression engine the mean effective pressure must be reduced by throttling to

$$p_{ca} = p_o \frac{V_h}{V_{ha}} = 82.9 \frac{382}{480} = 66 \text{ lb. per sq. in.}$$

Theoretically the fuel consumption varies in direct proportion to the thermal efficiency, and it therefore becomes

$$b_a = b \frac{\eta_t}{\eta_{ta}} = 0.585 \frac{0.41}{0.466} = 0.515 \text{ lb. per sq. in.}$$

which represents a saving of

$$\frac{0.585 - 0.515}{0.585} = \text{approximately 12 per cent.}$$

In reality the saving will be greater, as the assumption that the efficiency of combustion will be the same in the two cases does not hold, this factor being higher in the case of the super-compression engine, so that a fuel consumption of not over 0.485 lb. per horsepower-hour can be relied upon.

This calculation gives a valuable indication as to the direction in which there is a chance for the improvement of truck engines. The objection that the weight and manufacturing costs will be increased, owing to the greater piston displacement, is of little moment, as in the case of motor trucks the engine weight is not a very important factor, and any slight increase in manufacturing costs are compensated for by the saving in operating cost during a very short period. The life of such an engine, too, need not be shortened, as the specific bearing pressures can be kept low, and as the throttling in part neutralizes the influence of the super-compression on the pressure diagram. A more important feature is the increased difficulty of cranking, which, however, does not need to be considered where an electric starter is fitted. Possibly the fuel economy may be further increased by providing the carbureter with several spray nozzles and venturis, so that the engine may be fed a rich mixture when under full load, whereas when the engine is throttled to carry its normal load a second carbureter comes into play which delivers a very lean mixture.

Such a super-dimensioned and throttled engine possesses a considerable reserve of power, if the drive is sufficiently robust, as it is possible to operate it temporarily on a fully open throttle. The thought suggests itself that this may be taken advantage of by dispensing with the change speed gear. It may here be remarked, parenthetically, that this often discussed problem has lost greatly in importance through improvement in transmission design. It is true that we are still using clash gears, which according to ideas current in general mechanical practice are an exceedingly crude device, but through a long succession of improvements in design and construction material, in the clutch as well as the transmission, the formerly heavy, bulky and more or less unreliable transmission has shrunk to an unobtrusive excrescence to the engine housing, so that its elimination would not have nearly the same advantage which it would have had only a decade ago. As often happens in the history of mechanical development, time brings solutions of problems which previously staggered the most capable, when these solutions no longer are of any particular value.

A "Gearless" Car

With large cars, such as the eight-cylinder Cadillac, with its excellent clutch, one can start without difficulty on the direct drive and needs the transmission only on exceedingly steep grades and in backing. This idea of the gearless car was taken up by Maybach, who exhibited such car at this year's Berlin automobile show, with a six-cylinder engine delivering 70 hp. at 2000 r.p.m. The engine is fitted with a specially powerful electric starter, which is put in operation by pressing on a pedal, and as the clutch is not withdrawn, this starts the car as well as the engine. The starting pedal also connects to the throttle valve, opening the throttle as it is depressed, and as the ignition is then closed the engine picks up its cycle at once. A further depression of the pedal cuts out the starter. As the engine develops a very high torque, this pedal serves as the only control member for use on level roads and moderate grades. For exceptionally steep hills a "hill pedal" is provided which connects a planetary gear built into the flywheel housing into the transmission line without shock. In the intermediate position of the "hill pedal" the clutch is disengaged, so that it is possible to let the engine idle in special cases. Backing is effected entirely electrically, by reversing the starter. Even though certain objections may be raised against this solution of the problem, the boldness of the new idea must be acknowledged, which greatly facilitates the operation of the car by unskilled persons, since gear shifting is eliminated and instead use is made only of a single pedal, if we disregard the "hill pedal," which is used only in exceptional cases.

Weakness of Explosion Engines

This solution, consisting in the use of an exceptionally powerful starter, masks the inherent weakness of all explosion engines residing in the fact that they give a substantially constant torque, instead of increased torque at low speeds, like a steam engine. It is natural that the ideal solution of an explosion engine with variable torque must be matured first in the form of a stationary engine, which is subject to fewer restrictions with respect to weight, tending, bulk, etc. If we disregard the interesting, but so far unsuccessful, experiments with mechanical changeable transmissions, as, for instance, by a change of the stroke, the most direct method of increasing the output is the use of blowers.

Aircraft engines have been very successfully fitted with blowers, for the purpose of maintaining the output at great altitudes in spite of the decreased density of the

air, but the problem in connection with motor cars is an entirely different one. On the contrary, very remarkable results of tests on Junkers, stationary two-stroke engines are to hand, where by the use of sufficiently large blowers and throttling of the exhaust ports the output was temporarily increased by from 30 to 50 per cent, which results should be taken notice of in the further development of automobile engines. The chief objection raised to this construction is that it gives a machine which normally can be used only as a throttled motor and is therefore not fully utilized. This argument is not entirely valid, as the parts are so proportioned that the engine would not stand operating continuously under full load, as regards both mechanical stresses and heat disposal. Still more interesting in this respect is the Diesel engine of the Sulzer experimental locomotive, which on starting off is caused to produce a very high torque by overfilling with air under pressure. Owing to the high consumption of compressed air and the cooling requirements, this method of operation can be continued for only a short period, until from one-quarter to one-half the normal speed has been attained. From that point on both fuel and compressed air are blown into the cylinders, and as ignition of the charge is effected, a very "full" indicator diagram is obtained, corresponding to an overload. This is continued until the train has reached its full speed, whereupon the engine output is reduced to its normal value.

Extended laboratory tests make this method of operation appear satisfactory, but in practice so many detail difficulties must be overcome that years will be required to ripen a project of this sort.

Future of Research

In the case of the automobile engine this plan seems to have greater possibilities. The slight extra weight of the blower is compensated for by the elimination of the transmission; the stresses in the rear axle are not increased, and considerations of weight do not prevent a strengthening of the engine cylinders and drive mechanism. The flexibility of the engine and the form of the diagram in case of super-charging, as well as the influence on the inflammability with mixtures of different proportions are questions that still remain to be settled. An investigation of these problems would be a worthy task for American mechanical laboratories equipped with optical indicators and other suitable instruments, particularly since research work in German institutions has almost completely stopped, on account of lack of means due to the economic situation. An exchange of ideas which would make available to American engineers the results of many not yet fully exploited German researches as a guide for further research work, and by which German engineers might be acquainted with recent experimental results obtained in America, could only be of advantage to the engineers of the two countries.

THE Stevenson Gear Co. has recently brought out a down-stroke model of its multiple shaper or gear cutter, complementary to the up-stroke model described in AUTOMOTIVE INDUSTRIES of Aug. 25, 1921. This machine is known as the Model 6-A and resembles the vertical shaper or slotting machine in general appearance and principle of operation. The principal unit of the mechanism is a special tool head which consists essentially of a series of radially disposed tools spaced about the circumference of the blank to be cut. The machine operates in the same manner as an ordinary vertical shaper except that the tools are held stationary and the gear blanks are reciprocated past the tools.

Stability of Two-Wheeled Tractors

Usually in these tractors the torque removes weight from the drive wheels and transfers it to the implement on which rests an extension frame. The drawbar pull has the contrary effect if the drawbar is below the wheel axis. Mr. Heldt discusses other phases of this problem in this article.

By P. M. Heldt

THERE has been a good deal of discussion on the subject of the transfer of weight from the front to the rear wheels when a rear wheel-driven, four-wheel tractor has power applied to its wheels, and the fact is now thoroughly established that when the front end leaves the ground as a result of this effect, it is around the rear axle center line that the motion takes place. On the other hand, comparatively little has been said on the corresponding effect in a two-wheeled tractor. The reasons probably are that so far there have been only a few models of two-wheeled tractors on the market, and that in no case is there any danger of serious accidents when a machine of this type is pulling heavily.

Since action and reaction are always equal and opposite, it is quite obvious that the tractor, when power is applied to the wheels for forward motion, tends to turn backward with exactly the same torque or turning effort as that with which the wheels turn forward. To hold the tractor frame from rotating it is provided with a rearward extension, which generally rests upon the implement, but in some cases upon a two-wheeled truck furnished with the tractor. The product of the downward pressure upon the implement or truck, into the perpendicular distance from the axis of the tractor axle to the center line of this pressure, is equal to the torque on the driving wheels, and is known as the torque reaction. Of course, if the center of gravity of the tractor is located ahead of the driving wheel axis, a part of the weight of the tractor will also press down on the implement.

It is a general principle of mechanics that when a system is in equilibrium all outside forces on it vanish. The "system" here considered is the tractor, and the outside forces take effect at the center of gravity, at the points of support of the tractor and at the drawbar hitch.

When the tractor is at rest, with no power on its drivers, there are three forces active which must be in equilibrium. The force of gravity W acts at the center of the gravity

of the whole tractor, and is balanced by the ground reaction P against the wheel and the reaction p of the implement against the frame extension, as in Fig. 1. The moments around any axis vanish. For instance,

$$Wl = pL \text{ and } Pl = p(L - l)$$

Referring to this Fig. 1, it will be seen that the sum of the two reactions is equal to the total weight of the tractor, and the reactions

are inversely proportional to the distances of the points at which they occur, to a vertical line through the center of gravity of the tractor. As in this case the center of gravity is very near the wheel axis, the pressure of the wheel on the ground is far greater than the pressure of the frame extension on the implement.

If now power is applied to the tractor and a load is hitched to it, the previously existing outside forces are considerably changed in magnitude, and there is one more outside force acting on the tractor, namely, the reaction to the drawbar pull at the drawbar hitch. If we designate the drawbar pull reaction by R and the rolling resistance encountered by the tractor by A , then the tangential force at the wheel rim gives rise to a horizontal reaction of the ground against the wheel (the force which prevents

the wheel from slipping) which is represented by $A + R$. In order to obtain rational proportions we have assumed in the diagrams that the maximum drawbar pull is equal to three-fourths the weight of the tractor, and the rolling resistance equal to five-eighths this weight.

The tangential force at the wheel rim, represented by $A + R$, acting at the length of an arm r equal to the wheel radius, is balanced by a similar moment created by a reaction B at the point of contact between the frame extension and the implement, acting on a lever arm L , constituted by the perpendicular distance between the center line of this reaction and the wheel axis. We have then (Fig. 2)



Simple illustration showing how ground pressure can be reduced by torque reaction

hence

$$(A + R) r = B L$$

$$B = \frac{(A + R) r}{L}$$

This reaction is in the same direction as that due to the component of the force of gravity at this point (p); in other words, the pressure of the frame extension on the implement is increased by the torque reaction.

It has been intimated that the drawbar pull R is balanced by a fraction of the horizontal reaction of the ground on the drive wheels. But since these two forces are not in line they cannot completely balance each other. In fact, we took a moment of the reaction to the tangential force on the wheel ($A + R$) around the wheel axis, and we must also take a moment of the reaction to the drawbar pull around this axis. In the drawings we have assumed that the perpendicular distance a of the drawbar center line from the wheel axis is equal to one-third the wheel radius r . This moment tends to raise the frame extension and is contrary to the moments due to weight and torque reaction. The reaction to this moment at the point of contact between frame extension and implement, which is denoted by C , is therefore downward. This reaction

$$C = \frac{R \times a}{L}$$

The actual pressure of the frame extension on the implement in regular operation therefore is

$$p' = p + B - C$$

where

p is the reaction at this point when there is no power applied to the tractor wheels.

B is the reaction due to the driving torque.

C is the reaction due to the drawbar pull.

The first item, p , can be decreased by moving the center of gravity of the tractor closer to the wheel axis, and vice versa. The reaction due to the propelling torque can be decreased by lengthening the frame extension, and vice versa. The reaction due to the drawbar pull can be increased (which has the same effect as decreasing either of the two items) by placing the drawbar hitch lower. In general, smallness of pressure on the implement is desirable.

It is obvious that the pressure of the driving wheels on the ground when the tractor is under load depends also upon three items—

$$P' = P - B + C$$

That is, the pressure of the driving wheels on the ground when the tractor is under load depends upon the tractor weight component upon the wheels, an item depending upon the torque and an item depending upon the drawbar pull and the height of same.

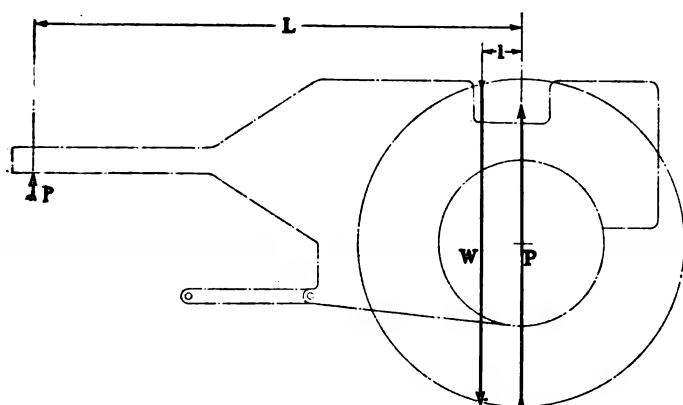


Fig. 1

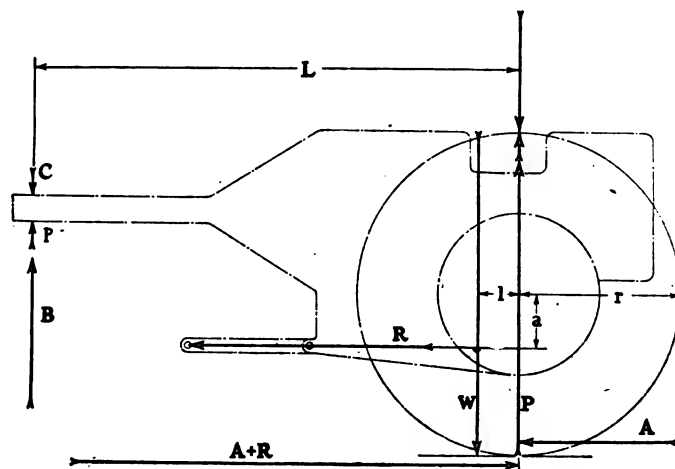


Fig. 2

That the drawbar pull adds to the load on the drive wheels if the drawbar is below the wheel axis is easily shown. In Fig. 3 are sketched the wheels and tractor frame in a diagrammatic manner, and the reaction of the implement on the drawbar, $C B$, and the downward pull, A, B , which must be exerted on the end of the frame extension to keep the frame in equilibrium, are drawn in. The resultant of these two forces, $O B$, takes the form of axle pressure on the wheel bearings and must be balanced by an equal and opposite reaction $O D$ of the ground of the wheels. This reaction is inclined and has both a horizontal and a vertical component. The horizontal component $O E$ is part of the resistance to slippage of the wheel on the ground, while the vertical component $E D$ constitutes an increase in the vertical reaction of the ground on the wheel, and hence in the pressure of the wheel on the ground.

We want the greatest possible pressure of the wheels upon the ground, because upon this pressure depends the maximum drawbar pull of which the tractor is capable. This means that B (Fig. 2) ought to be made small, by using a long frame extension or small wheels, and C large, by placing the drawbar low or making the frame extension long. Of course, the greatest pressure of the drivers on the ground that can possibly be obtained is equal to the total weight of the tractor. The sum of the reactions at the point of ground contact and point of contact with the implement is always equal to the weight of the tractor—

$$(p + B - C) + (P - B + C) = (p + P) = W$$

If it were possible to make B and C equal then the pressure of the drivers on the ground could be made inde-

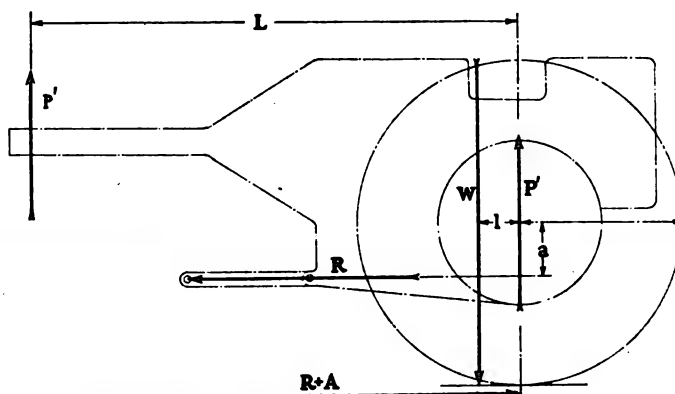


Fig. 4

Improvements in Gearbox Design

Part III.

In this article Mr. Orcutt deals with factors in the production of gearboxes. He shows how weaknesses are revealed by an examination of the costs of production and offers suggestions for improvements in gearbox design.

By H. F. L. Orcutt*

IN no way are the anomalies and weaknesses of the gearbox so clearly revealed as through an investigation of costs of production. Such an investigation is specially recommended as a stimulus to reform in design and in methods of production. It will reveal that when the best running qualities are desired in proportion to its size, number of parts, and machine operations, the gearbox is a costly unit. It will reveal that a box with almost any elaboration of design necessary to secure good running qualities will be cheaper to produce than the conventional type with all its uncertainties of costs, both direct and indirect.

With regard to costs, motor car boxes may be broadly divided into two classes: Those in which the costs are known, and those in which they are unknown. The "known" class includes those boxes which are produced under well-organized conditions, where labor-saving machines are properly equipped with up-to-date tools. Wide clearances are allowed, limits are not very fine, no fitting is called for; costs of assembling are low and it is done by unskilled labor. The teeth of gears are cut with plenty of backlash, with no stoning, or "running in," and no scrap. Noisy running is tolerated, boxes are never pulled down after road tests. The costs of these boxes are low, and in many cases they give good service, but are nearly all very noisy. There is nothing in the problem of production of this class of box that is not well within the capacity of most makers of components. All the machine operations are of the ordinary class, the costs of which are common knowledge. The foregoing applies principally to the so-called three-speed box. As long as the public is satisfied with their running qualities, so long will the maker continue to supply this class of work.

Niceties in Gearbox Manufacture

The "unknown" class of gearbox might well be called the "unlimited" class as far as costs are concerned, for many makers never stop work on them until they run to the satisfaction of their road testers. They may pull them down once or a dozen times; work is put into them regardless of expense and time—the whole output of cars is often held up through faulty gearboxes. A forecast of their cost is impossible, and an estimate of what they really do cost is so involved and mixed with other costs that no exact figure can be given. Hundreds of pairs of gears have been seen in more than one motor car works which are thrown aside as scrap. In many works all costs on gearboxes after the first machining and bench work are charged either to erecting and testing, or considered a part of "on-cost." Much depends on the de-

gree of silence that is expected. Some well-known makers are content with silent running for the constant-mesh gears only, others add the third speed. Quiet running on second and first speeds is given up altogether, and reverse gears are rarely bothered with, no matter how badly they may run. Very few indeed make any attempt to secure equally quiet running on all speeds.

Good Workmanship Reduces Assembling Cost

In boxes where the best running qualities are desired, costs are usually enhanced by inaccurate machine work. It should not be forgotten that the central idea should be so to design and make the gearbox that it will support accurate tooth contact. Limits of workmanship have been given without which the best results will not be secured in any design. These limits are adhered to by but very few makers of either good, bad or indifferent boxes. Inaccurately seated ball bearings are a fruitful source of unnecessary costs. They have a narrow face compared with the diameter. For this reason they can be easily tilted in the casing. The outer ring should fit in the housing to a nicety which closely approaches gage work. They can be easily pushed home in such a manner as to permanently upset the soft metal casing, resulting in more noise perhaps from bearings than from the gear teeth. Dismantling and re-assembling gearboxes alone often cures this defective alignment, certain noises disappear but costs are increased. Hole-grinding in gears is not always kept within the limits necessary for good mounting. Bad broaching is common, and combined with inaccurate shaft work runs up fitting costs and often neutralizes good work on gear teeth. An examination of a large number of splined shafts reveals the fact that in many the finish-ground cylindrical surfaces are not concentric. This is largely due to bad centering. Results—bearings do not line with each other and gears run out. Bad workmanship in splined shafts and gear teeth is the rule, not the exception. The limits which should be observed on these details have been given above. The added costs due to the defects mentioned are naturally uncertain, irregular and difficult to assess. They include "running in" and hand-stoning gear teeth, fitting which is wholly unnecessary, dismantling and reassembling, and road testing wholly for gearbox rectification. With many makers road testing for gearbox troubles alone is a formidable item of costs which is wholly chargeable to gearbox production. These costs include wear of tires, fuel, testers' time and general mileage costs, all not infrequently repeated a number of times. Scrap parts are often a large item in costs, and are wholly unnecessary.

Regardless of design, the best running results can only be expected where correct and uniform workman-

*Paper read before the Institution of Automobile Engineers, December 15, 1921.

ship is the rule. With correct workmanship, gearbox assembling should be an unskilled operation, even when the best results are expected. There should be no fitting work whatever. Gears need no stoning or "running in," boxes should not be dismantled and reassembled, special road tests should not be required. Scrap is unnecessary. The designer should be the first to insist on good workmanship, for without it he cannot trace inherent defects, nor try out improvements with any certainty. The engine designer would never have made the progress which he has if he had not been backed by the superior workmanship which is commonly found in the motor car engine. Very few makers would consider for a moment assembling an engine with its principal components made with the indifferent workmanship we usually find in the gearbox. It is doubtful if there is any other working surface in the motor car except the gear tooth which is hardened after it is carefully machined. As with the engine or the axle, the cheapest box is the one which is accurately machined, that is, if the best results are desired. The difference between the costs of irregular and regular machine operations is small, inspection costs may be slightly increased; assembling and fitting costs are the lowest when good machine work can be relied upon.

As to costs of scrap on gears when they are finish-ground, many records show that 1 per cent is ample allowance. The same figure can be taken for splined shafts when they are correctly machined.

Finishing Gear Teeth

The greatest interest naturally centers on the cost of gear-teeth finishing, as this is the most costly of any machine operation in the gearbox. The producer has the choice of various methods. There is not much difference in the costs of ordinary gear-cutting when the best machines are employed in either the generating, hobbing, or plain milling processes. Good, bad and indifferent qualities of work are produced by all methods, much depending on experience and on the methods and supervision employed.

When results are desired which call for gear-tooth treatment after hardening, there is a choice of three methods:

1. "Running in" and stoning.
2. Finishing with a cutter.
3. Grinding with the abrasive wheel.

Grinding with the abrasive wheel gives a quality of tooth form that cannot be produced by any other method; this quality includes theoretical accuracy as well as uniformity, and when the highest quality is required it is the cheapest. When design is suited to production and quantities are possible, gear-tooth grinding adds little, if any, to the cost of the gearbox. Quality for quality, it is the cheapest method that can be employed when total costs are considered. Stoning and "running in" are makeshift processes, irregular in cost and quality. Finishing with a cutter after heat-treatment gives better results than hand-finishing. The greatest additional cost is in maintenance of cutters, which wear rapidly. Strict supervision is necessary to maintain uniformity—only certain grades of hardness can be tolerated. Accuracy of tooth form necessary to very quiet running is impossible.

As a means of reducing costs and assisting to regular output, accurate machining of the splined shaft is second in importance to gear-tooth finishing. There are three forms of shafts for driving gears: the square shaft, the cylindrical shaft, with an inserted key, and the so-called splined shaft. The splined shaft is used in two ways, with the gears mounted on the tops of the keys, and with

gears mounted on surfaces between the keys. There is only one method of driving which is recommended as possessing the combined virtues of high quality and low costs. This is found in the splined shaft on which gears are mounted on the circular surfaces between the keys. Mounting gears on the tops of splines or on a square shaft may be considered as a practically impossible method of securing uniform results and one which is consequently costly. The difficulty in both cases is in finishing the inner surfaces of the gear which take the bearing on the shaft. When these surfaces are hardened, costly hand work is necessary to finish them to anything approaching a degree of accuracy. When the gears are mounted on the circular surfaces of the shafts which is between the keys, the hole in the gear can be cheaply ground within fine limits. The splined shaft can also be ground so accurate that no fitting between the two parts is called for, and the gear will run so truly that with good teeth the best possible running qualities are secured. If a box so finished is noisy in running, better workmanship will not cure the evil—design must be studied until inherent defects are corrected and costs due to these defects are eliminated.

Inaccuracies in Gear Teeth

There is one peculiar feature of gearbox costs which is worth special examination, and which is not a regular item of production expenses. It is caused by gearbox troubles which are experienced by many makers. These troubles follow intervals of steady output with those who turn out cars of good quality with fairly quiet running gears. Suddenly car after car is turned down by the road inspector and the whole output is held up by gearbox defects. It is a costly business. It is so sudden and disastrous that it might well be termed an epidemic. Investigation often reveals the origin in defective gears, defective in the teeth or mounting. It has been stated that the allowable variation from accuracy in gear teeth is smaller than is usual in the finest grinding work if the best results are desired. The facilities and the experience for keeping gear work within these fine limits exist in but very few workshops. Often large quantities of gears are hardened and completely finished with inaccuracies that can only be detected by a running test. These errors are large enough to cause bad running, but are so small and of such a nature that they are not to be found by ordinary methods of gear inspection. They may be due to the displacement of tooth-form caused by wear in tooth-cutting machines, or in wrongly shaped or wrongly set cutters, or an alteration in the heat-treatment.

It is usually a costly business to face a trouble of this nature. Gears which are hardened after they are finished and are found to be faulty are not easily recovered. Some times the teeth can be ground to correct form so that they run well even with a backlash of 0.025 in. or 0.030 in. If this operation will not save them, they must be added to the scrap heap or badly running boxes must be accepted. If detailed work on gearbox parts is carried out as suggested, spasmodic troubles of the nature described should not occur. Exact costs of gearboxes in which the best running qualities are expected should be capable of being forecasted just as well as in those boxes in which noise is considered of no importance. To avoid unnecessary costs care should always be taken to make certain of the origin of the gearbox troubles. Many times it has nothing to do with the box itself; it sometimes can be traced to defective work in the engine, in couplings or in shafts. When corrections in these parts are made noises in the gearbox disappear.

It may be disappointing that more definite figures as to gearbox costs are not given. They are so difficult to ascertain that exact records are not often kept. As before stated, costs of the original mechanical operations on parts are common knowledge and do not vary to any extent. One thing is certain, the gearbox is more directly responsible for hold-up in output than any other part of the car. This is very costly, and through improved design and workmanship should be eliminated. When it is, exact estimates of costs can be made and relied on. Accurate workmanship is recommended as the indispensable precedent to alteration in design. A complete return of costs should be an indication as to whether the best methods of production are employed or not. Startling revelations await more than one manager who may insist on having a complete return of costs of car production for which the gearbox is directly responsible.

Without doubt, some of the gearbox eccentricities which add to the cost of production are due to heat

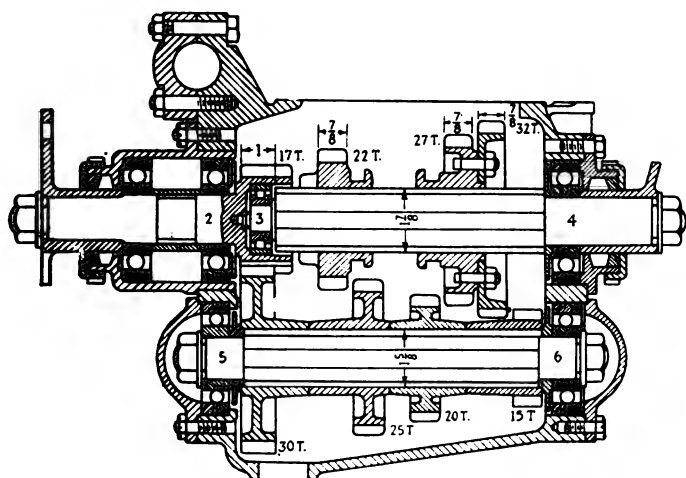


Fig. 5

generated by oil-churning. Thin aluminum casings are easily distorted by heat. Otherwise, the conditions of service which the gearbox has to fulfill are purely mechanical. It should have features of design and specifications of workmanship so that costs could be exactly calculated. Mechanical and assembling operations, clearances, limits, inspections and tests, should be planned as they are for thousands of other mechanisms. In so far as all these details are not definitely dealt with in the course of production, costs will be uncertain. It will, perhaps, be well to repeat the most common workshop irregularities which add to costs:

Most Common Faults

Ball bearings badly mounted in casings.

Spigot ball bearings badly mounted in the constant mesh position.

Inaccurate workmanship on splined shafts.

badly mounted, especially when the gears seat on flats or on square shafts.

1 badly mounted with too much clearance and too much backlash.

1 Added to the common lack of correct specifications, of clearances and limits, of good methods of inspection. As to design, costs are increased by corrections which must be made in boxes easily deflected by internal strains and chassis distortions, and by badly designed details. Costs of this nature can only be re-

duced by the designer himself. There is another detail of design which is often the source of trouble and expense. In both lay shaft and main shaft in many boxes it is possible to lock up the ball bearings so that they are subjected to permanent end strains. It should not be forgotten that in good ball bearings the clearances are only a few ten-thousandths of an inch, and consequently they can be easily unduly strained. If they are so mounted that they must take a load or resist a strain which they are not made to carry, they will give trouble which is costly to locate and to correct. Correcting the errors of workmanship above mentioned and insisting on an inspection by which limits are kept to specification should do more than reduce costs of production. Running qualities would be much improved in all boxes, and a definite line would be drawn between troubles due to workmanship and those to design. These troubles are so often intermingled that they cannot be clearly observed and correct remedies cannot be applied.

When costs of assembling and erecting are low, it may be assumed that fundamentals of design and methods of production are not bad. Some examples of assembling costs will be given for a few boxes, in all of which the quality of workmanship is the best and the running qualities are satisfactory, although the design is more or less conventional.

Time Required for Assembling

Example 1.—A 6-ton truck gearbox with four speeds and reverse. Time of assembling, 6 hr. Time includes all labor for fitting work and assembling of all parts, bearings, shafts, gears, selector and brake parts. This box is never dismantled, but is put into the chassis and never removed. No parts are scrapped. There is no "running in," nor gear-teeth stoning. The running qualities are the best.

Example 2.—A three-speed and reverse gearbox for 15-hp. car. Time of assembling complete, 5 hr. The time includes all labor for assembling and fitting shafts, bearings, gears, change-speed levers, all brake parts, speedometer-drive, cover and housing for universal joint. The box has the best of workmanship throughout and the best running qualities.

Example 3.—A 3-ton truck gearbox with four speeds and reverse. Time of assembling complete, 4 hr. Labor includes assembling all parts of the box except the brake. These boxes were the subject of special inspection for quiet running. In several thousand boxes there was practically no scrap.

The above times given for assembling include the complete cost of the gearbox from the time the machined parts are received from stock until the car is ready to deliver to the customer. They are representative of what should be accomplished on any car of the best quality.

There are records of numbers of cases where changes in limits and new specifications of accuracy were adopted, with the result that dismantling, scrapping and repeated road tests were reduced from a large percentage to practically nothing. Better running qualities were secured and costs reduced.

Suggestions on Design

In Figs. 5 and 6 are shown different designs of gearboxes, Fig. 5 illustrating the weaknesses of a common design of box, Fig. 6 suggesting lines on which an improved box may be evolved.

The power transmitted in both boxes is 35 b.h.p. at 1500 r.p.m. The gear ratios are nearly the same, and the gears selected are 6 D. P., 20 deg. angle of pressure.

The contrasting features of design are principally in

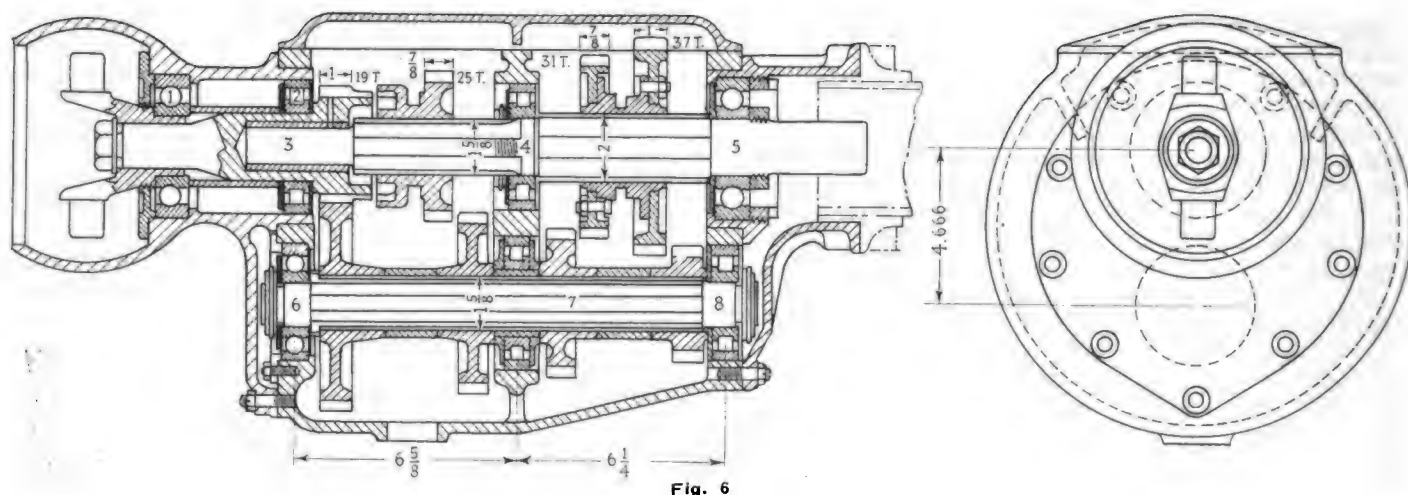


Fig. 6

the method of mounting, the shape and material of the casing, the center distances between the shafts and the distance between the bearings. A special feature of Fig. 6 is the central bearing. It is believed that the circular form of the casing in Fig. 6 will resist stresses better than the box form as in Fig. 5. Two methods of mounting the improved design are shown, the object in both cases being to avoid transmitting chassis distortion to the box itself. In Fig. 6 the ball end to the casing could be set in a socket secured to a cross-member of the frame, the rear end of the casing being secured to the torque tube. The front and rear ends would be malleable castings and the central portion would be of aluminum. With this construction the casing would be well reinforced and further strengthened by a vertical wall in which the central bearings would be housed. In Fig. 6a the box is bolted directly to the engine casing, a practice which is to be noticed in many new designs. It seems to predominate in American and French cars. A few models are now made with the ball joint and torque tube mounting.

The outside dimensions of Fig. 6 are greater than those of Fig. 5. The distances from bearing to bearing in Fig. 6 are $6\frac{5}{8}$ in. and $6\frac{1}{4}$ in. as compared with $10\frac{1}{4}$ in. in Fig. 5. The center distances are 4.666 in. in Fig. 6 and 3.9166 in. in Fig. 5, a difference of $\frac{3}{4}$ in. This increase in center distance is fully as important as the decrease in the lengths of the shafts between the bearings. Larger gears can be used, and there is ample space for housing ball bearings, which are well above their load. Contrasting velocities, loads and stresses are shown in Table I. The velocities of the gears in Fig. 6 are very

Table I

Gear	Gear Velocity, Load and Stress					
	Pitch Line Velocity		Tangential Load		Stress, Lb. Per Sq. In.	
	Fig. 6	Fig. 5	Fig. 6	Fig. 5	Fig. 6	Fig. 5
C. M. pinion.....	1,244	1,114	928	1,038	17,750	20,600
Third slider.....	1,040	928	1,105	1,240	22,400	25,800
Second driver.....	840	742	1,370	1,555	27,750	32,300
First driver.....	638	556	1,805	2,070	34,500	49,250

little higher than in Fig. 5; the loads and stresses are very much less. Good construction is difficult when the center-distance between the shafts is small. Sometimes it is so restricted that ball bearings cannot be used with a proper load-capacity, as indicated in Table II. In this table the maximum bearing loads, the revolutions per minute, and the bearings with safe loads as given by the makers, are shown. In the design shown in Fig. 6 it is possible to use ball bearings with safe loads in all cases. In the design in Fig. 5, on account of the close center-distance, it is impossible to use the makers' "safe-load" ball bearings in bearings 2, 4 and 6. Roller bear-

ings with "safe" loads could be used in 2, 4 and 6. In this case, however, an end thrust bearing should be added in bearing 4. Table III has been compiled to show the maximum and safe loads on bearings which are di-

Table II

Bearing Number	Maximum Actual Loads and Safe Loads Fig. 6			Maximum Actual Loads and Safe Loads Fig. 5		
	Max. Load, Lb.	R.P.M. of Bearing	Safe Load, Lb.	Max. Load, Lb.	R.P.M. of Bearing	Safe Load, Lb.
1	297	1,500	1,540	420	1,500	1,180
2	1,287	1,500	1,500	1,327	1,500	1,180
Spigot						
3	262	.....	.....	1,662	532	*1,220
4	1,202	620	1,880	1,925	400	1,370
5	1,505	396	2,500	810	850	1,320
6	803	770	1,490	1,870	850	1,320
7	1,030	770	1,890			
8	1,575	770	2,930			

*If a ball bearing is fitted here, as is often the case, it would have a safe load of 620 lb.

rectly comparable in Figs. 6 and 5. The pilot bearing in Fig. 5 design is shown with rollers. It is often a ball bearing too small to carry the load. Results which are of special interest seem to be brought about by the in-

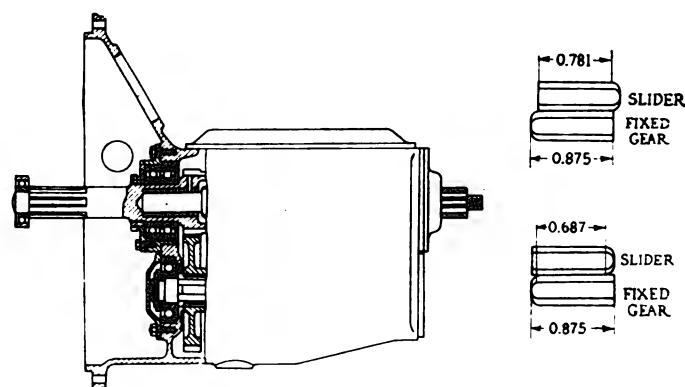


Fig. 6A

Fig. 7

roduction of a central bearing, as in Fig. 6. Table IV has been compiled to show the effect of this bearing in the distribution and minimizing of loads. The maximum bearing load in Fig. 6 is 1575 lb.; in Fig. 5 it is 49,250 lb. The minimum load in Fig. 6 is 297 lb. The results are instructive.

Bearing Number	Maximum Actual Load		R.P.M.	Safe Load	
	Fig. 6	Fig. 5		Fig. 6	Fig. 5
1	297	420	1,500	1,180	1,180
2	1,287	1,327	1,500	1,180	1,180
3	262	1,662	.....	1,220	1,220
4	1,202	1,925	620	1,370	1,370
5	1,505	810	396	1,320	1,320
6	803	1,870	770	1,320	1,320
7	1,030		770		
8	1,575		770		

The pilot bearing is an inherent weakness of the standard gearbox. With the central bearing this weakness is partly neutralized. The overhung ball race in Fig. 5 supporting the pilot end of the main shaft should be contrasted with the plain pilot bearing in Fig. 6, which is seated well inside the constant-mesh pinion. In Fig. 6 this bearing on the first speed and second speed takes no load; in the third speed it takes 262 lb. contrasted with first, second and third speeds in Fig. 5 of 275 lb., 758 lb. and 862 lb. respectively. Bearing No. 6, in Fig. 5, is a bearing which in nearly all four-speed boxes takes the heaviest load when the first-speed gears are engaged. In the box of one well-known car two ball bearings are used in this position. The contrast is, in Fig. 6 (bearing 8), 1575 lb., in Fig. 5 (bearing 6), 1870 lb.; in Fig.

TABLE IV

Bearing No.	Loads in Lb.					
	First Speed		Second Speed		Third Speed	
	Fig. 6	Fig. 5	Fig. 6	Fig. 5	Fig. 6	Fig. 5
1	297	420	297	335	297	340
2	1,287	1,327	1,287	1,045	1,100	1,045
Pilot						
3	0	275	0	758	262	862
4	415	1,925	1,202	897	918	458
5	1,505	810	258	635	0	630
6	803	1,870	803	900	650	480
7	230		1,030		820	
8	1,575		292		0	

5 (bearing 4), on first speed the load is 1925 lb., compared with Fig. 6 (bearing 5) on first speed, 1505 lb. There are several instances where the loads on bearings in Fig. 6 are heavier than on the same bearing in Fig. 5. As pointed out, the increased center-distance in Fig. 6 allows the use of bearings with plenty of surplus capacity. In Table IV tooth pressures are contrasted. The difference in the loads on the gears in Fig. 6 is due to the widths of the gears and the fact that the gears so that the full possible working tooth is made use of. This is often overlooked in the design of a gearbox. Fig. 7 shows the method of overloading suggested, which increases the length of the box by 1 in.

The gears in Fig. 6 are reduced in variety as far as possible. The gear teeth numbers are duplicated; there are two 19-teeth, two 25-teeth, two 31-teeth and two 37-teeth gears. The variety of teeth in the gears in Fig. 5 is quite common, and is an unnecessary addition to costs and trouble in gear-tooth finishing. The gears in Fig. 6 are in all cases designed to facilitate the cheapest production on the most costly operation, that is, tooth-finishing. Some of the gear teeth can be finished in four at one setting. The sliding gears in Fig. 6 have a much better seating on the main shaft than the sliding gears in Fig. 5; the space between the fixed gears is, however, greater in Fig. 6 than in Fig. 5, but shaft deflection is prevented by the central bearing. That portion of the main shaft on which the second and first-speed gears slide, is made larger in Fig. 6, principally to facilitate

assembling. The particular design of the first, second and third-speed sliders is suggested in Fig. 6, so that these gears, when under load, will be close to the supporting bearings. As the gears taking the heaviest loads, the first speeds in Fig. 6 are made with a wider face than the third and second-speed gears.

Recommended methods of locking up bearings are shown in Fig. 6. They are so locked that the end thrusts are taken on the ball bearings Nos. 1, 5 and 6. The other bearings are rollers and have a free end movement. With this construction it is impossible to throw loads on to the ball bearings which they are not made to carry. It hardly needs to be mentioned that with the central bearings all gears are well supported when under load, much better, indeed, than they would be with abnormally large splined shafts with no central bearing. Production costs of a box made on the lines suggested in Fig. 6 should be but little in excess of those of a box as in Fig. 5. The number of parts is increased by two central bearings, and the end pieces to the casing are more expensive. Weight will be somewhat increased, but this is essential to substantial mounting for highly stressed gearing. For many years the endeavor has been made to get good results from the conventional design—it has failed. The motor car maker must decide whether he will carry on with the old type or not. No box is known in which are embodied all the principles shown in Fig. 6, though each separate detail is to be found in different boxes. To get the best results they should be combined. To do this and not increase weight over that of the usual design is impossible. As previously stated, stability and rigidity must be the guiding principles of gearbox design. These principles cannot be adhered to if flimsy construction is permitted. With correct methods of manufacturing, total costs of produc-

TABLE V

Gear	Tooth Pressure per Inch of Contact					
	Total Face, In.		Actual Contact, In.		Lb. per In. of Contact	
	Fig. 6 In.	Fig. 5 In.	Fig. 6 In.	Fig. 5 In.	Fig. 6	Fig. 5
C. Mesh	1.0	1.0	1.0	1.0	990	1,100
Third Speed	0.875	0.875	0.781	0.687	1,510	1,920
Second Speed	0.875	0.875	0.781	0.687	1,870	2,410
First Speed	1.0	0.875	0.8125	0.687	2,360	3,200

tion of an improved design need not exceed those now paid when the endeavor is made to supply a good running box of inferior design.

Fig. 6 is intended to illustrate as far as possible the principles which must be followed in gearbox design if quiet running is desired. No claim can be made that a box exactly as shown will be the ideal box. As before stated, such a box cannot be produced without individual experimental and development work. Design will vary, of course, to meet the service called for by the car in which it is mounted.

Simplified Theory of the Magneto

Gears on the tops of keys. Standards has recently made some experiments on the tops of keys. Holes in gears ground to the limits. Holes too roughly finished. Irregular-shaped gear teeth.

This paper, which has been found useful in the design of the high-tension magneto. While the circuit is relatively simple, and consequently can be used as a basis for deriving definite mathematical formulas for induced volt-

ages and similar quantities, it has been found experimentally to correspond quite closely in its performance with the highly complicated electrical circuits of an actual magneto. In the paper, formulas are given for the voltage induced in the secondary under various conditions of operation, and a number of numerical examples are worked out, showing the application of the equations to a variety of practical problems.

A copy of Report No. 123 may be obtained from National Advisory Committee for Aeronautics, Washington.

The "All-Purpose" Tractor on the Modern Farm

Farmers must have machines designed to perform a multiple of tasks, not those for one or two uses. This writer is of the opinion that unless a change to this effect is brought about the industry will go backward.

By J. S. Clapper*

I KNOW I am subjecting myself to criticism by some of the tractor men in going on record by saying that unless some changes are made by the manufacturers, and that very quickly, the tractor business has reached its peak and it will be a long time before the farmer can be persuaded to accept the present type of machine and to do his part in motorizing his farm.

There is too big a gap between what the manufacturer receives for his product and what the farmer has to pay. The manufacturer does not get enough money to later meet all the demands made by the selling organization and the user. I am of the opinion that the tractor industry has reached the most critical period in its history and, whether it goes forward or goes backward, depends entirely upon the manufacturer and the sales organization through which all products must find an outlet.

That the tractor business is sick, we must all admit, but, how many of the manufacturers have made the proper remedy, I do not know. But I do know that some of the large manufacturers of accessories, necessary to the production of tractors, as well as the managers of some of the most prominent advertising mediums are fully awake to the situation and are trying to place some of the actual facts before the manufacturer. We all know that it takes more courage to correct a mistake than to suffer with it for years.

From my observation I am thoroughly convinced that the farmers have been quicker to appreciate the possibilities of applying mechanical power to their farm operations than the manufacturer and I base this statement on the fact that the manufacturers as a whole have held to a "one-purpose" machine, expecting the farmer to arrange his work to fit the machines instead of analyzing the farmer's conditions and supplying him with a machine that will fit the work to be done on his farm. I think this comes more from following the old custom of designing and perfecting a machine or implement to do one certain class of work.

In the development of the tractor in the early days there were only two operations considered by the manufacturer: first, the breaking out of the large acreage of prairie sod and, second, the pulling of separators for threshing or belt power. I often wonder if the manufacturer of farm implements has ever given the farmer the credit he is entitled to for the part he has played in developing and perfecting every farm implement that has been put on the market. It was the farmer who first discovered he could pull disk-harrows and a battery of seeders and hook up the binders for cutting grain with his tractor.

No one who has any knowledge of farming with horses, in the strictly grain section, and has seen them replaced

by a well designed tractor can question its adaptability and the wonderful saving over horses, and it was in this field that the present type of tractors have been developed and found such a ready market but this field is small as compared to the entire acreage cultivated; besides, I'm wondering if the demand has not already been supplied.

A tractor designed to meet all the conditions and requirements in the diversified farming sections will find five prospective purchasers where there is one for the "one-purpose" machine. It is only necessary to consult the government figures, that show the annual acreage devoted to row crops every year in the different states which must be cultivated from three to five times each season, to convince anyone of the possible demand for the all-purpose power plant on the farm.

I believe the government report further shows that there is a total annual loss of \$232,644,000 because of weeds in corn, cotton, potatoes, beans, sugar beets, sweet potatoes and soy beans from the lack of proper cultivation, and it has been my firm conviction for several years that with the experience we have all gone through, it was entirely practical and feasible for the engineers and manufacturers to correctly analyze the farmer's requirements and hold their designs and actual accomplishments to fit the work to be done.

The most difficult operation in farming is the first and second cultivation of the tender plants and, unless the operator has an entirely unobstructed view of the rows and the machine has the necessary flexibility so that the cultivating teeth or the shovels will respond promptly to every move of the operator, good clean cultivation is not possible without injury to the plants. Unless we can give the farmer a machine capable of doing equally as good cultivating, easier and more economical to operate and which will perform the work faster with less effort on his part than can be done with horses, we have little argument to persuade him that he should motorize his farm.

What argument can a salesman put up to the farmer today to persuade him to invest twelve to twenty-five hundred dollars in a machine with the present price of horses and feed when the records show tractors have replaced only 30 per cent to 22 per cent of the horses. What would be the result if another salesman could show this same farmer a machine so adaptable to his work that it would actually replace 75 to 80 per cent of his horses and 40 to 60 per cent of his surplus labor and the price was within his reach.

The machines must be readily adapted to the different classes of work and at a price within the farmer's purchasing power, which has now reached the lowest point in our history.

The "all-purpose" machine or a machine so designed

*President of the Toro Motor Company, Minneapolis. Condensed from a paper read before the Minneapolis Section of the S. A. E.

that it can be easily adapted to more different kinds of work on the farm is entirely practical and will be readily accepted by the farmer who is looking for more improved and economical methods. I do not want to be classed as a pessimist as there is no one engaged in the tractor business more optimistic over the possibilities of power farming or the success of motorizing the farm than I. We must motorize our ideas and our own products before we can expect the farmer to motorize his farm.

On January 1, 1920, the Agricultural Department at Washington reported a total of 246,000 tractors on the farms in the United States or about one farm out of every 28. The states showing the highest percentage of all farms, reporting tractors in 1920 were as follows:

South Dakota	16%
North Dakota	15%
Montana	12%
California	10%
Kansas	10%
Illinois	9%
Iowa	9%

The complete report released by the department covering the year 1920 gives the total valuation of all farm equipment manufactured in the year 1920 at \$537,000,000. The report further shows there were manufactured in 1920, 203,000 tractors, the value \$193,000,000 or more than one-third of the total of farm equipment. It is estimated there were about 160,000 of these tractors marketed during the year.

Now, let us take the acreage of the four principal crops for ten years. The report shows as follows: In 1910 there were 69,000,000 acres of corn; in 1919 63,000,000 of corn or 3,000,000 less than in the year of 1910.

In 1910 there were 32,000,000 acres of wheat; in 1919 53,000,000 or an increase of 11,000,000 acres.

In 1910 there were 27,000,000 acres of oats; in 1919 31,000,000, an increase of 6,000,000.

In 1919 there were 14,000,000 acres of cotton; in 1919 15,000,000 acres, or an increase of 1,000,000 acres.

These figures would indicate there has not been a very great increase in the acreage of the four principal crops during this period but the figures show that the value of farm implement equipment during that period has increased 185 per cent.

It has been the custom of the Agricultural Department to tabulate each season the totals of 22 of the principal crops, one-half of which are row crops requiring cultivation. The following figures are given by states, indicating the difference in valuation of these 22 crops produced in 1919 and 1920:

New York.—Of the 22 crops, there was a drop of \$23,000,000; of the total crop, a drop of \$32,000,000;

Pennsylvania.—Of the 22 crops, there was a drop of \$50,000,000; of the total crop, a drop of \$77,000,000;

Maryland.—Of the 22 crops, there was a drop of \$18,000,000; of the total crop a drop of \$23,000,000;

New Jersey.—Of the 22 crops there was a drop of \$3,000,000; of the total crop, a drop of \$6,000,000;

Ohio.—Of the 22 crops there was a drop of \$173,000,000; of the total crop, a drop of \$199,000,000;

Illinois.—Of the 22 crops there was a drop of \$344,000,000; of the total crop, a drop of nearly \$400,000,000;

Iowa.—Of the 22 crops there was a drop of \$263,000,000; of the total crop, a drop of \$450,000,000; and

Minnesota.—Of the 22 crops, there was a drop of \$197,000,000; of the total crop, a drop of \$212,000,000.

It will be noted that the loss in the middle and western states is considerably greater than in the New England states. This is an indication of the shrinkage in the valuation the farmer has taken in the last 12 months.

As regards the machines produced the following figures show the number of manufacturers and sizes of machines made in 1920.

Horsepower	No. of Manufacturers	No. of Machines
8 hp. and less	6	7,678
9-15	8	3,366
16-18	17	107,782
19-22	17	39,964
23-26	24	18,073
27-32	33	12,861
33-39	10	1,410
40-59	15	3,684
60 and over	13	1,389
Total		203,207

Value: Of this total number manufactured, only about 29,000 were estimated sold for export, leaving 175,000 for domestic trade. The total of all farm equipment manufactured during 1920, amounting to \$537,000,000, only \$66,000,000 was estimated sold for foreign trade, leaving \$471,000,000 for our domestic trade.

It must be remembered our export on all lines of farm equipment declined during the war while production was normal except in 1918 and our surplus, formerly going to Europe, was accumulating here. Then with our enormous increase in production during

1919 and 1920, caused by the urgent appeal of the Government officials, is it not only reasonable to assume we would have felt the effects of over-production in the farm equipment line even though the farmer's product had held up in prices. If you will consult the records as far back as you please, you will find this one thing: Whenever our imports go up and our exports come down so that the imports exceed in value our exports, we feel the effect in all lines of business and not until our surplus begins to move to foreign countries, does business improve to any marked degree.

A great deal has been said and written about selling the country banker on farm tractors. Few really consider the matter from the banker's standpoint. The banks are not in position to extend further accommodations to the farmer until he has liquidated some of his present debts.

A majority of the farmers, who want to buy a gas tractor on time, want the banker to go back of the deal and take the gas tractor as security. We all know that after the machine has been used for one or two years, and put up for sale under foreclosure at the end of the season, it brings a very small part of the purchase price. Besides the banker must judge at the outset whether in his opinion the tractor is going to be a profitable investment for the farmer, especially if he is furnishing the money. If he does not think it will prove a profitable investment, and the farmer has no other resources behind him to take care of the obligations when they come due he naturally refuses to lend the money.

I believe the country banker has been criticized too severely for not financing the farmer in tractor sales.

Fifth Semi-Annual Gasoline Survey

Bureau of Mines reports results of investigation into price and physical characteristics of fuel sold in various localities throughout the country. There has been but little change in quality during the past year, but the price, normally lower in winter, is higher than last summer.

IN order to obtain information concerning changes in the character of motor gasoline, the Bureau of Mines two years ago began a series of semi-annual surveys. The fifth of these, covering gasolines marketed in January, 1922, has just been completed.

The July, 1921, survey showed that the average motor fuel sold at that time had a surprisingly high volatility. This was contrary to expectations, because for a number of years past "summer quality" gasoline has been much less volatile than "winter quality." Gasoline stocks were largely drawn upon during the summer and the country entered the winter period with little more gasoline in storage than is normal.

The present survey shows that the quality of the gasoline being sold during the present winter is, on the whole, similar to that sold a year ago. This indicates that the condition of high volatility reported last summer was only temporary and that there has been no radical change in the refining or marketing methods employed.

Present tank wagon prices are practically the same as last summer. The following table gives some comparative tank wagon prices (in cents per gal.) in the cities indicated:

	July, Jan.	1921 1922	
New York City	24.0	25.0	+ 1
Washington	22.0	22.0	Same
Pittsburgh, Pa.	22.0	23.0	+ 1
Chicago, Ill.	18.0	19.5	+ 1.5
New Orleans, La.	17.5	21.5	+ 4
St. Louis, Mo.	17.4	18.9	+ 1.5
Denver, Col.	22.0	21.0	- 1
Salt Lake City, Utah ..	25.0	25.5	+ 0.5
San Francisco, Cal ...	23.0	21.0	- 2
Average	21.2	21.9	+ 0.7

The bureau's first gasoline survey was made in 1915, a second in 1917 and a third in April, 1919. Two limited surveys were made in 1920. All of these showed a continuous decrease in the volatility of gasoline, probably due to an increase in demand. By January, 1921, however, the volatility had increased to some extent and since that time there has been little change in the gasoline marketed.

Although the general average for the entire country

shows very little change from last year, differences are noted when individual cities are compared. A decided improvement is observed in the gasoline sold in Salt Lake City, the initial boiling point decreasing 13 deg. F., the end point decreasing 27 deg. F. and the average boiling point decreasing 24 deg. F. Gasoline sold in Washington, D. C., also showing an improvement, initial boiling point being lowered 20 deg. F.

In this survey 119 samples of gasoline were collected from nine cities, the samples being taken as in previous surveys. The analyses were made in accordance with the methods given in Technical Paper 214 of the Bureau of Mines, entitled "Motor Gasoline," by E. W. Dean. The actual specific gravity at 60 deg. F., corresponding Baumé gravity, initial boiling point or "first drop," 20, 50 and 90 per cent points, end point and average boiling point, and the percentage recovered in the receiver were determined for each sample and tabulated. The average figures for each city, as obtained from this tabulation, are collected for purposes of comparison in the table below, which also includes the average for the nine cities, and an average for the eight cities included in the January, 1921, survey.

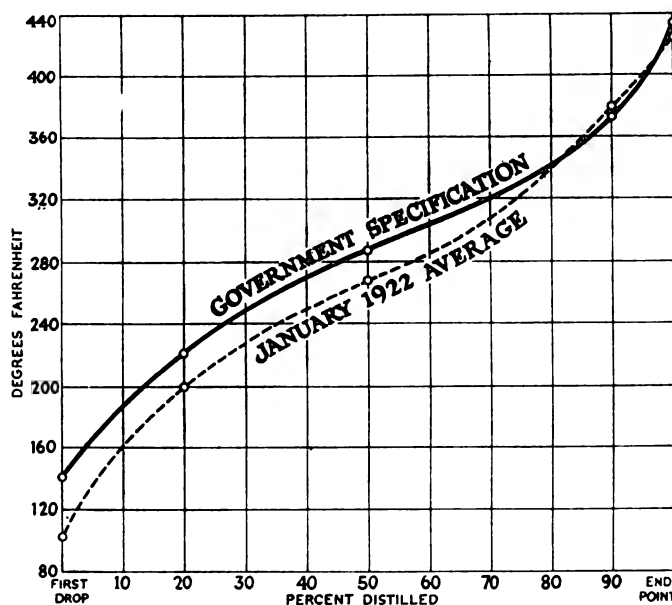


Chart showing how the average distillation curve of gasoline sold throughout the country compares with Government specifications for this fuel

Average Results of Motor Gasoline Survey, January, 1922

	Specific Gravity	Baume Deg.	First Drop	20%	50%	90%	End Pt.	Avg. B.P.	Per Cent Recovered
District									
New York City...	0.742	58.6	109	205	268	368	421	268	96.1
Washington, D. C.	0.751	56.6	98	195	259	380	428	264	95.8
Pittsburgh, Pa. ...	0.733	61.3	93	176	256	390	430	260	94.0
Chicago, Ill.	0.751	56.6	104	208	272	386	442	270	96.4
New Orleans, La. ...	0.744	58.3	114	212	274	371	428	273	97.3
St. Louis, Mo.	0.743	58.5	96	205	279	386	435	274	95.5
Denver, Col.	0.746	57.8	104	201	266	378	432	268	97.0
Salt Lake City, Utah	0.744	53.2	99	197	261	362	412	261	96.6
San Francisco, Cal.	0.763	53.6	112	208	261	359	421	264	97.2
Average for 9 cities	0.745	58.0	102	200	267	377	430	267	96.0
Average for 8 cities included in January, 1921, survey	0.745	58.0	102	199	266	377	430	267	95.9

Tables were also prepared comparing the averages of each city with those of January, 1921, and with July, 1921.

A distillation curve of the average figures for January, 1922, was prepared as well as the curve for Federal Specification gasoline. Distillation curves for the average figures of January and July, 1921, would be practically identical with that of January, 1922, which is given above.

Authorities Show Need for More Efficient Use of Petroleum

One presents in perspective the economic facts relating to petroleum and interprets these facts in their relation to the oil and allied industries. The other authority deals with the utilization of liquid fuels and his book serves to give the engineer a clearer picture of the combustion process.

By Herbert Chase

“**W**HETHER the output of petroleum in the United States has actually or almost reached its maximum rate is immaterial. Likewise, the exact size of the unmined reserve is of secondary importance. The point to be emphasized is the coming necessity for increasing the overall efficiency of petroleum—a problem that concerns not only the producers and refiners of oil but the manufacturer of appliances that consume its products as well. From now on the tendency will be to use relatively less of the material itself, but to put greater effort into increasing the service value extracted from it.” Such is the statement contained in the preface to a book entitled “The Economics of Petroleum,” by Joseph E. Pogue (John Wiley & Son), one of the two best books dealing with various aspects of the liquid fuel situation which have come to our notice within the past year. Standing alone, such a statement would call for relatively little notice, but when made as a result of perhaps the most thorough and comprehensive study of the economics of petroleum ever made, it is worthy of careful consideration. This, indeed, may be said of the book as a whole. The data used are of the most authoritative character and are presented with unusual care and in excellent graphical form. Present trends are projected into the immediate future in cases in which the author considers this feasible from the data in hand.

Fuel Consumption

When the people of one representative State, Ohio, spend from \$80,000,000 to \$100,000,000 annually on fuel for automotive vehicles, the Experiment Station of their State University need offer no apology for compiling a bulletin in which the economical use of this fuel is discussed at some length. Just this has been done by Prof. C. A. Norman on behalf of the Experiment Station of Ohio State University, and the 200-page book, entitled “The Economical Utilization of Liquid Fuel,” which has resulted (it is known as Bulletin No. 19 of the Engineering Experiment Station), is a credit both to the university and the author. Professor Norman, in concluding his book, expresses the hope that adherence to the existing type of throttling carbureting engines will not prevent courageous and broad-gage engineering development in the prime-mover field. He sees great prospects for the injection type of engine for automotive use, but does not reach his conclusions without making a thorough analysis of the advantages and disadvantages of the conventional and various other types.

The opening chapter of Doctor Pogue's book outlines the economic organization of the petroleum industry,

and the second deals with the resource situation. Maps and charts showing the distribution of the important oil pools of this country and the world and their relative importance are given. Successive chapters deal with the trend of oil-field development and oil production, the transportation of crude, refinery practice, capacity and outlook. Chapters IX and X, which deal with gasoline and kerosene, should be of special interest to the automotive industry, since its products are by far the largest users of gasoline and also consume large quantities of kerosene. The characteristics and source of straight-run, natural-gas gasoline and cracked gasoline are briefly discussed, and interesting charts, which show how the endpoint has increased and to what extent the total supply has been affected by this increase and by other factors, such as cracking and the use of casing-head, are given. Other charts and the accompanying text cover the various factors affecting demand and show how the demand is divided between various classes of automotive equipment.

Status of Kerosene

The present status of kerosene and the various factors of supply and demand are discussed in similar fashion. It is pointed out that the future requirements for motor fuel loom so large that it is questionable whether it will not ultimately cease to be marketed in any large quantity. The chapter on fuel oil is of less direct interest to the automotive industry, but shows that the future demand for this fuel will probably come largely from automotive sources, as a result of the probable conversion of fuel oil into automotive fuel, on the one hand, and from shipping on the other.

“Lubricating Oils” is the title of Chapter XII, which deals with a subject of prime importance to the automotive industry. Various classes of lubricating oils are discussed and the demand and supply analyzed. It is shown that the demand for automotive lubricants accounts for about a quarter of the nation's output, and that this demand has placed a high premium upon the heavy-bodied cylinder stocks which have consequently risen rapidly in price and are more and more difficult to secure in adequate quantities. This situation has been further aggravated by the tendency toward fuel dilution of lubricants which has accompanied the use of fuels with higher endpoint.

Succeeding chapters deal with petroleum by-products, natural gas and gasoline derived from it, marketing, export and price of petroleum products, relation between price and production of crude, the bearing of automotive transportation upon the oil industry, and the economic

significance of cracking. Chapters XXI and XXII, dealing with composite motor fuels and the motor-fuel problem, contain but little that is new to readers of *AUTOMOTIVE INDUSTRIES*, but include concise statements on these subjects which can be read with profit even by those who know the fuel situation in its broader aspects, and should prove illuminating to both automotive engineers and executives whose close consideration of immediate problems in their own routine work often find them without a broader knowledge of the fuel situation, which is, after all, of paramount importance.

The concluding chapters of Pogue's book deal with the city-gas problem, international aspects of petroleum, Mexico as a source of petroleum, the relation of the coal industry to the oil industry, oil shale, full utilization of petroleum and the function of statistics in the petroleum industry—subjects which have a more important bearing upon the automotive industry than a mere reading of the chapter titles can possibly indicate. Treatment of these subjects rounds out the author's consideration of the economics of petroleum in most satisfactory fashion, and leave one with a feeling that time spent in reading this book is well spent, as it is for all who appreciate or desire a thorough understanding of the important part which petroleum plays in our modern civilization.

The Economical Utilization of Liquid Fuel

A grasp of the general economic situation in respect to petroleum is a valuable asset, but it is quite as, or perhaps more, important for engineers to understand how fuel energy can be used to best advantage in the development of power, and it is with this in mind, among other objects, that Professor Norman has written the bulletin referred to above. This bulletin is divided into three parts, the first dealing with the oil fuel situation, the second with fuel utilization in combustion engines, and the third with a scientific discussion of combustion engine processes. Articles 1 and 2 of Part I treat briefly of the resources and consumption of petroleum and the forms of oil and their uses, and Article 3 with petroleum substitutes. Much of this information is similar to that under corresponding heads in Pogue's book, but is necessarily much more condensed, and in some instances not quite so nearly up to date as that presented by Pogue, though considerable material useful to the engineer and not given by Pogue is included. Particulars regarding certain physical and chemical characteristics of various grades of gasoline, benzol and alcohol, including the distillation curves of these fuels in their commercial form, are given.

The author quite properly draws attention to the poor average efficiency of automobile engines, especially under prevailing part load conditions, and sees much promise in the development of the injection type of engine, which is more efficient, especially under light loads, than the conventional type.

In Part II the nature of fuel, of combustion and of the heat value of fuel is explained, and the heat values and air requirements for a number of fuels are given. The function of expansion in converting combustion heat into power is then considered, and the necessity for early completion of the combustion and of maximum possible expansion for good fuel utilization is stressed. It is emphasized that compression is of importance to fuel economy only by enabling expansion, and it is pointed out that the fuel economy of Diesel engines is better at reduced load than at full load because the expansion at reduced load is greater than at full load. The variation in mixture requirements of present-day carbureting engines for best economy is discussed.

The evil effects of the burnt residue on the fuel economy of throttling carbureting engines at reduced load is pointed out and various means proposed for overcoming these effects are referred to. The progress of combustion is considered; likewise the nature of knock and the methods of overcoming knock. The difficulties resulting from poor evaporation and distribution of the fuel are taken up and various methods of fuel conversion and charge heating are scrutinized. The influence of friction losses on economy at reduced loads forms the subject of one article; the influence of vehicle speed and gear ratio, that of another.

Comparison of Prime Movers

Steam engines and injection engines can run on fuels heavier than those which a carbureting engine can utilize. Both these classes of engines show better maintenance of economy at reduced load than does the present-day carbureting engine. The possibilities of these two types of prime movers for automotive purposes are discussed and the strong points of each are pointed out.

While Part II contains considerable material that will not be new to those who are familiar with elementary thermodynamics and other related information upon which engine design is based and, while much material already published in papers read before the Society of Automotive Engineers and elsewhere is quoted, the chapter is well worth study and can be read with profit even by those well acquainted with these subjects. It contains, furthermore, some tabular and other data useful for reference purposes.

Part III, as its title indicates, is largely a scientific and somewhat theoretical though none the less useful consideration of the combustion engine process. The treatment of the subject is primarily of interest to students of thermodynamics, but is so presented as to be readily used by most engineers who are apt to have the inclination to apply it, as they may well do in their analysis of problems to which it refers. The author has made an effort to present the material as clearly as possible and in very usable fashion. The data on dissociation and on specified heat of combustion gases at various temperatures is of great value, as is also the entropy chart which the author and his associates have worked out with no little labor and, the author believes, for the first time in American units. It is of great value in the study and understanding of combustion phenomena, and is a credit to those concerned in its preparation. By its use it is possible to closely predict the probable efficiency of various types of internal combustion engines, including gas turbines.

Germany to Resume Aircraft Manufacture

NO aircraft has been manufactured in Germany since the acceptance of the Treaty of Versailles. Production of aircraft in that country was prohibited for a certain period by the peace treaty, and this period was later extended as a penalty for the destruction by the Germans of a number of Zeppelins which, according to the peace terms, were to be delivered to the Allies. This prohibition period expires on May 5 next, at which time the Allied Air Control Commission, under the direction of the British Air General Masterman, will discontinue its activities.

While the aircraft industry in Germany has been dormant for the past four years, it was kept alive by the Government, which recognized in it a great national asset. Now that the Germans can resume the manufacture of commercial airplanes without restrictions, it is expected that the business will develop rapidly.

Economics of Highway Transport

This outline shows the scope of the highway transport field and the study necessary for development. Economic phases of highway transportation are discussed and illustrated by means of a Topical Outline Chart.

A TOPICAL outline of data to be developed concerning the economics of highway transport has recently been issued by the Highway and Highway Transport Education Committee. This outline, while tentative in nature, indicates clearly the scope of the highway transport field and the studies necessary in its ultimate development. While issued primarily for the aid of teachers and students, this outline is of definite interest to manufacturers, since the automotive industry is basically interested in the development of the educational work involved.

This preliminary topical outline of the economics of highway transport was prepared by Lewis W. McIntyre, assistant professor of civil engineering, University of Pittsburgh. It is designed to stimulate interest in the economic phases of highway transportation and to aid the experiments being carried on by experts in various parts of the country, to whom officers and taxpayers alike may turn for the fundamental data without which developments of this character cannot be intelligently planned.

The report presenting the outline states that "the outline makes no pretense of being either complete or ade-

quate." It has been limited in various ways. The newness of the subject and the consequent lack of authoritative research make definite conclusions and principles impossible.

Some of the topics are capable of considerable expansion; their use will be determined by the local situation. Others may be used almost as outlined. It is confidently expected that use of the outline will develop innumerable suggestions for its revision. Such suggestions and constructive criticisms will, we are informed, be greatly appreciated.

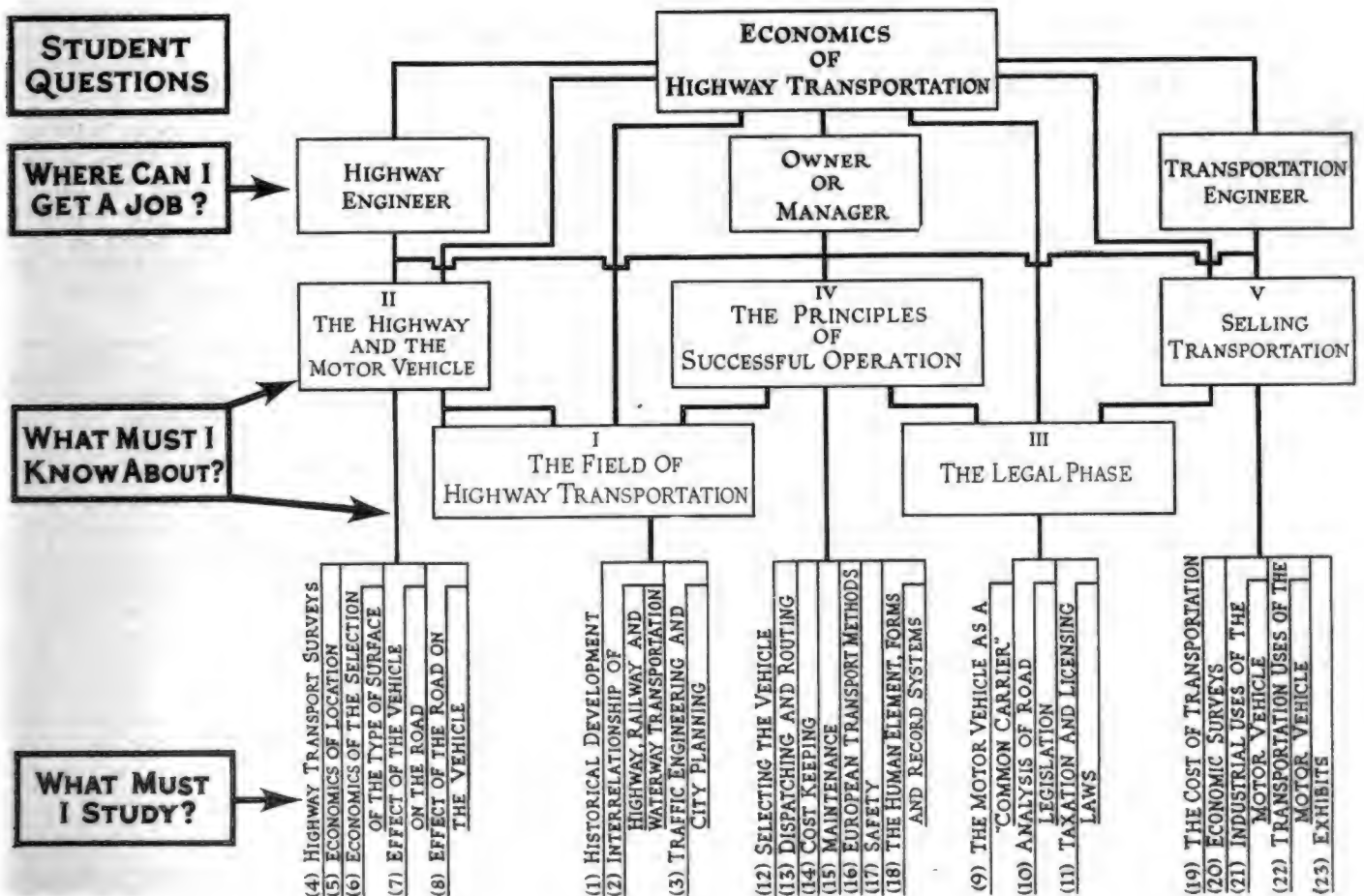
The outline is as follows:

I—The Field of Highway Transport

(1) Historical Development.—Steps in the development; relation of transportation to civilization; problems awaiting solution; magnitude of the problems; the highway program; the field for trained men; salaries available; probable future development.

(2) Interrelationship of Highway, Railway and Waterway Transportation.—Correlation of all forms of service; the electric railway and highway transport; the steam railway and highway transport; the waterway and highway transport.

(3) Traffic Engineering and City Planning.—Relation of



transportation problems to city planning; historical development of city transportation; street traffic problems; street railway problems; traffic regulation.

II—The Highway and the Motor Vehicle

(4) Highway Transportation Surveys.—The traffic census, its purpose, use and limitations; economic survey of transportation; needs of local industries; use of vehicle registration data; intangibles; capacity; peak loads, etc.

(5) Economics of Location.—General considerations; minor details of alignment, distance, curvature, rise and fall and their effect on the cost of transportation; ruling gradient and curvature; typical calculations of effect of these items on operating expenses; justifiable expenditure for their reduction; virtual profile.

(6) Economics of the Selection of Type of Surface.—Adaptation of motor vehicle and highway to one another; limiting factors; economical traffic unit; typical calculation of economical traffic unit; other factors affecting type of construction; economical life.

(7) Effect of the Vehicle on the Road.—Type of vehicle; horse-drawn, high-speed, rubber-tired motor truck stresses induced; types of failure; effect of weight; effect of speed; impact; experimental investigations; types of roads, rigid and non-rigid; traffic intensity; unsprung weight; pneumatic tires.

(8) The Effect of the Road on the Vehicle.—Stresses in motor vehicle; stresses due to load; twisting strains caused by road irregularities, shocks caused by rough roads; driving shocks and loads; braking shocks and loads.

III—The Legal Phase

(9) The Motor Vehicle as a Common Carrier.—The Trend of existing legislation; operation on regular routes; hauling for selected patrons; passenger service; freight service; effect of regulation; result of non-regulation; arguments pro and con; constitution of the regulating body.

(10) Analysis of Road Legislation.—Development of the theory of road laws; analysis of existing laws; effect on transportation; possible changes.

(11) Taxation and Licensing Laws.—Methods of taxation,

gasoline tax, tonnage tax, tax according to use, etc.; weaknesses of present systems; outlook for the future.

IV—The Principles of Successful Operation

(12) Selecting the Vehicle.—General requirements; types available; factors affecting selection; body design; trailers; demountable bodies; special bodies; tires.

(13) Dispatching and Routing.—Fundamental principles; scheduling; co-ordination of loads and vehicles; zone system; analyzing routes by time studies; minimizing delays at ferries, terminals, etc.; selecting of routes; loading and unloading devices.

(14) Cost Keeping.—Importance; desirability of uniform system; results desired; data necessary; National Standard Cost System; Commercial Vehicle System; other systems.

(15) Maintenance.—Serious effect of improper maintenance; lubrication, inspection; effect of over-loading; effect of over-speeding; typical systems of maintenance; garage problems.

(16) European Transport Methods.—European transport problems and their solution; application to American conditions.

(17) Safety.—Grade crossings; guard rails; footpaths, etc.

(18) The Human Element, Forms and Record Systems, Etc.—Importance of esprit de corps and how to maintain it; typical bonus systems; mechanical checking devices; bills of lading, etc.

V—Selling Transportation

(19) The Cost of Transportation.—Factors entering into complete cost of transportation; crating; terminal charges, etc.; effect of road conditions on cost of highway transport.

(20) Economic Surveys.—Purpose; surveys of business operations; public haulage surveys; community transportation surveys.

(21) Industrial Uses of the Motor Vehicle.—Farming; lumbering; mining; factory; construction.

(22) Transportation Uses of the Motor Vehicle.—As feeder to railways and waterways; flanged wheel equipment; inter-city trucking companies; rural motor express; motor buses; local uses.

(23) Exhibits.—Highway, rubber and automotive exhibits.

A Comparative Report on Rubber Tire Exports

SOME thirty sizes of metric tires, twenty of inch-size fabrics and twenty-two of inch-size cord tires are included on the export list. This was shown in a recent statement made by the Rubber Division of the Bureau of Foreign and Domestic Commerce, listing the exports during two representative months of last year. The figures were compiled from reports to the Rubber Association of

America, Inc., representing more than sixty individual firms. The two-month record shows the variation in percentage. Its chief interest is in the sizes and in the comparison of clincher and straight-side. Three-fourths or more of the fabric tires, inch size, are shown to be of clincher construction, while more than four-fifths of the cord tires were straight-side. The figures follow:

Metric Sizes	Per cent total for July	Per cent total for November	Inch Fabrics Sizes	Per cent total for July	Per cent for November	Cord Tires Sizes	Per cent total for July	Per cent total for November
700 x 80	.5	8.8						
700 x 85	.2	.3						
750 x 85	...	...	30 x 3 1/2	...	...	30 x 3	...	...
710 x 90	2.6	1.8	28 x 3	19.7	...	30 x 3 1/2	16.5	11.1
760 x 90	4.7	1.4	30 x 3	42.6	...	32 x 3 1/2	...	2.2
810 x 90	3.3	1.3	31 x 3 1/2	...	...	31 x 4	.2	...
910 x 90	...	...	31 x 3 1/2	...	54.7	32 x 4	7.3	5.5
760 x 100	...	.8	31 x 4	7.3	6.9	33 x 4	10.4	9.5
810 x 100	...	...	32 x 4	...	1.0	34 x 4	2.8	2.1
870 x 100	...	...	33 x 4	...	4.5	32 x 4 1/2	...	27.0
765 x 105	2.0	3.1	34 x 4	...	.9	33 x 4 1/2	...	7.2
815 x 105	...	...	36 x 4	...	...	34 x 4 1/2	...	8.2
815 x 105	9.9	22.8	32 x 4 1/2	...	14.3	35 x 4 1/2	...	2.96
875 x 105	2.4	5.1	33 x 4 1/2	...	.3	36 x 4 1/2	...	.7
915 x 105	...	...	34 x 4 1/2	...	1.2	33 x 5	...	2.6
815 x 120	...	2.3	35 x 4 1/2	...	.5	34 x 5	...	.2
820 x 120	24.7	9.1	36 x 4 1/2	...	.2	35 x 5	...	5.6
875 x 120	...	.8	33 x 5	...	...	37 x 5	.04	...
880 x 120	32.9	13.1	34 x 5	...	...	36 x 6	...	3.2
920 x 120	4.7	4.0	35 x 5	...	.1	38 x 7	...	1.3
1020 x 120	...	...	36 x 5	...	...	40 x 8	...	.7
815 x 125	.7	...	37 x 5	...	...	42 x 9	...	...
875 x 125	...	...	Misc.	5.0	1.9	44 x 10	...	...
820 x 135	1.0	4.8				48 x 12	...	...
880 x 135	2.6	6.7				Misc.	...	.5
895 x 135	1.3	4.5						
920 x 135	.1	...						
935 x 135	4.4	3.6						
895 x 150	.5	5.7						
935 x 150	.2	...						
Misc.	...	...				
Total				74.6	25.3	Total		

*Sizes marked thus amount together to a total of 1/10 of 1%.
x Sizes marked thus amount together to a total of 1/10 of 1%.

*Negligible quantities.

Labor Courts Do Not Solve Problem

Ten States are planning to pass bills modeled after the Kansas Industrial Court law. Despite immediate advantages such courts do not go to the heart of the problem. Labor and rewards should not be standardized.

By Harry Tipper

THERE are pending in ten states bills modeled along the lines of the Kansas law for the establishment of industrial courts with the expectation of eliminating strikes. The effect of the Kansas law has been considered satisfactory by many people interested in the subject, and there is a definite agitation for further laws of this type. The American Federation of Labor is very active in combating these laws and a large part of the time in the hearing before Committee of the New York Legislature was devoted to the speeches of Gompers and others from the Federation ranks against the introduction of such a bill. The industrial court, as it has been established, has not eliminated the strike, although it has undoubtedly prevented a good many strikes from maturing and has lessened the losses incident to many of the local strikes which occur frequently from trivial causes and without any sound reason.

This method of dealing with industrial disputes does not prevent the dispute at all, or do anything to take away the original reasons for disputation. It simply attempts to limit the dispute and to impose a settlement before the production is stopped by the impossibility of agreement. It has many advantages, but it is not a cure-all for industrial troubles as so many sponsors seem to feel. It must take into consideration only general conditions involved in the strike and these conditions invariably resolve themselves into wages or hours of labor, etc.

One of the important difficulties in modern business is the standard of wage and the tendency to classify all workers of a group by the same standard compensation. Laws of this kind tend to legalize this classification and to further standardize compensation. This is not desirable.

The whole weight of modern study of the labor problem should be put upon the development of the industrial unit as an organization and, therefore, the elimination of separate classifications of workers and management. Otherwise the differences that are continually disturbing the industrial fabric will continue, in spite of industrial courts, national conferences or other means of adjustment.

The factory is not an organization as it stands at present, and it cannot be an organization until the spirit and machinery of organization is such as to provide a common viewpoint and object through the entire working force. None of the legal methods so far proposed are of any value in this particular, and no systems could be suggested of a general character which would be of any value.

While the introduction of these bills before the legislatures of ten states is indicative of the activities of many people who are looking for a short cut to the millennium of industrial peace, the progress of experiments in individual industrial organizations is a very much more important indication of the real tendency of affairs. Since the earlier profit sharing and employee representation experiments were developed, there have been established in the United

States over 1300 such systems in individual factories or other establishments. From the progress of these experiments and from their influence upon surrounding conditions, we shall be able to study the possibilities in increasing human efficiency and organization unity much more closely. The wide diversity in the character of these experiments, the common object of organization building which inspires them, and the common desire for increased efficiency which maintains them, offers a hope of progress not exhibited in any of the general systems and legal suggestions so far put forward.

On the surface, the problem of securing labor efficiency and a reasonable degree of stability and contentment is not so acute as it was in the after-war period to the middle of 1920. Statistics show, however, that almost as many strikes have occurred of late as occurred in the previous period, and the general record of the movement of labor does not suggest that the problem is different from what it has been.

The introduction of these bills before various State Legislatures indicates a revival of the tendency to introduce legal restrictions upon the industrial settlement of these matters, a tendency which we have referred to many times in *AUTOMOTIVE INDUSTRIES*. The hearings which have occurred indicate a lack of interest on the part of business in the progress of political action upon labor matters. There are a number of individuals and groups actively engaged in promulgating the idea of industrial courts for adjustment of disputes, and of other legal machinery for the settlement of industrial disturbances. It will be necessary for business men to analyze these suggested methods and determine, with a full knowledge of the situation, if they are likely to prove of value. Otherwise, the corporations in various states may find themselves limited in their organization development, and in their discussions and conferences with bodies representing labor, by the legal machinery provided by the state. Because of the fact that these methods are being proposed in so many states, an analysis of the original Kansas law would be interesting and important to manufacturers. We shall undertake this in an article in the near future.

Despite the advantages from an immediate standpoint, the establishment of industrial courts does not present a solution of the matter and in some particulars is to be questioned.

One point should be understood very thoroughly in connection with all general means suggested for legislative action regarding industrial disputes. All industrial courts, national adjustment conferences, or other legal bodies, will tend to encourage the formation of labor and employee associations, unions or other bodies, because the necessities of the work of adjustment will require the affected parties to associate themselves more closely, in order to use their combined strength in disputes.



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Systems

INCREASING competition and the difficulties in finding a market for a large automotive production are lending impetus to the study of markets. To do this many different systems of definite values will be instituted and others which will prove invaluable after a tryout, but in any event the action decided upon must be carried through to a conclusion.

Information on marketing subjects is only valuable in so far as it is accurate. The system employed to obtain market information is only valuable in so far as it is rigidly adhered to by those persons who are responsible for carrying it on. Following the action through entails a careful and constant checking up on the system, and this should be done by authorized representatives who realize the necessity for accuracy.

Much can be done to make employees realize the importance of perpetually keeping up a system by giving them an insight as to its object and instill respect for it by a businesslike checking up.

A system which is allowed to "run to seed" does nothing but breed contempt for itself and expense

for the company. If such laxity is continued it becomes increasingly difficult to gain co-operation for any system whether its value is apparent or not.

Fundamental Research

THERE are so many industrial problems requiring fundamental research that the automotive manufacturer can scarcely be blamed if he fails to find time in the course of a busy life to follow in detail the various developments. In another sense, however, there is no business more important to the permanent progress of industry than the proper conducting of just this fundamental research and the proper interpretation of its results.

Fuel research, for example, is vital to automotive development. Although some of the work going on may seem a bit super-scientific to the average executive, he can well devote time and effort to fostering and encouraging such efforts by responsible agencies, for upon the successful solution of the problems involved depends in a great measure the future of the automotive industry.

Standardization work, although involving chiefly engineering problems, has a definite bearing upon commercial development. The elimination of waste in manufacturing and selling is being investigated and constitutes another problem for fundamental research of vital character.

Labor and unemployment research is about to be carried on under Herbert Hoover's supervision in a manner never before attempted in this country. The research is now being outlined and when completed will be of extreme value to industry, provided industrial managers furnish the essential co-operation in gathering the necessary data. This survey will first take account of what is shown by the present inadequate statistics concerning unemployment. Data will then be compiled showing types of unemployed, unemployment problems that require further data, under-employment, an index of employment, relation of unemployment to business cycles, and present social cost of cyclical employment. On the basis of this data conclusions will be drawn, the various proposed remedies will be analyzed in the light of the facts developed, and plans for future improvement will be laid out.

While all these researches are slightly removed from the very immediate daily problems of the executive, they are concerned with vital questions pressing for solution in the very near future. The data which they are designed to develop are essential to the efficient and progressive functioning of the automotive industry.

Advertising Appeal

"THE appeal to snobbishness in automobile advertising is a dead letter. Prospective buyers want to know what transportation service they get for their money." Such was the statement made recently by an advertising man handling high-class accounts. It is a fact that many manufacturers of cars in the upper price group use the appeal of exclu-

siveness as their strongest selling talk. This brings forward the question whether the advertising man's statement was wrong or whether he was just one jump ahead of the crowd. It remains to be seen.

It is evident that prospective buyers of cars in the lower price group are weighing values as never before. The question arises whether the same searching tests for value are being applied by the prospective purchasers of high-priced cars.

Luxury and refinement of appearance have always been more or less stressed in high-priced car advertisements, while the idea of sustained fine performance has been used in a minor key. Is this the best way to sell the cars? Is it not possible that many people would buy high-priced cars if they realized that they were buying more than luxury of appointment and appearance? Are there not many people that appreciate high quality to whom exclusiveness carries little weight?

The increasing refinement in the medium-priced car makes it imperative to give a close examination to the selling argument of refinement. A careful analysis of the reasons for the sale of each high-priced car would undoubtedly furnish much information of value in determining just what advertising appeal will bring in the greatest return.

What Do Dealers Want?

THE last year and a half has seen a survival of the fittest among dealers. Dealer turnover has been high in many car organizations. Competition for good dealers is on the increase. The need for efficient and sound dealers has become a necessity. These facts make it interesting to analyze what factors in a manufacturing organization are likely to be attractive to the best type of dealer.

Dealers are just human beings, so it may be laid down as a general rule that the best type of dealer will react favorably to the same sort of appeal as will the best type of man in general. Considering this in conjunction with the necessity for more efficient marketing, it would appear that practical co-operation in the solution of marketing problems will be one potent appeal. The appeal made by one car manufacturer, for instance, in seeking new dealers illustrates well the sort of constructive, sane help that is likely not only to help build a good dealer organization, but also to go far toward reducing marketing costs. This manufacturer in attempting to sell his franchise to dealers, advertises in part as follows:

"How profitable is a Blank franchise? What can I make? How many prospects in my territory? Are sales increasing? These and many other questions will be gladly answered by our Opportunities Department. This department devotes itself to surveys of territories now having Blank representation and those where openings exist.

"It does not generalize, but gives facts. It can show, in actual figures, what results have been obtained in different territories. But it will be glad to study your own community very thoroughly and show you what can be expected."

The company which knows most about its market is in the best position to allot territory and to take on dealers to the mutual profit of all concerned. Knowledge and facts are coming to play a larger part each year all along the line of automotive marketing.

The \$348 Car

FOR years Ford has stood supreme in the low-priced passenger car field, and through the establishment of a wonderful production plant and organization, an unusual marketing system, so far as the sale of cars is concerned, and a liberal service policy, has come to occupy a position which has been thought unassailable by many who are presumed to know the trade. Emphasis has, however, always been placed upon the production of a completely standardized product, the design of which has remained practically unchanged for a decade, while many competitors have incorporated refinements which the public has learned the advantage of having. This has proved a highly profitable commercial policy for Ford, who has been able to sell all the cars he could build during most of this period, but has in a way played into the hands of his nearest competitors in the price scale, who have had good arguments to advance in respect to features not incorporated in the Ford chassis and body. A large proportion of the car users in this country have appreciated and been willing to pay for refinements, many of which were prohibited under the policy which Ford has followed.

Now comes Durant, with wide experience in the industry, and, with the aid of parts makers whose combined facilities are perhaps as great as Ford's and rather more flexible, announces a plan for the production at Ford's present prices, of a car which incorporates many of the refinements and other features which have come to be associated with cars in the next higher price scale than the present Ford.

This, of course, has created intense interest upon the part of the whole passenger-car industry and resulted in much speculation as to what move Ford will make when and if the new competitive factor is developed to the extent anticipated. It also furnishes food for thought as to the probable effect upon the market for cars in the next higher price class than that directly involved.

The parts makers have long been a large factor in the automotive industry, and may be on the road to becoming a still larger element. On the other hand, Ford has apparently found it more desirable to make than to buy most of the components in his cars, and now follows this practice to a large extent. Whether experience will ultimately prove that a similar course is expedient in the case of the new product shortly to be placed in production remains to be seen. The results of the new venture will in any case be watched with great interest, and will, it seems certain, serve to heighten competition in the low-priced car field. However, Ford has a long start and a reputation for rendering real service to the users of his product—a policy which those who seek to compete with him cannot afford to overlook, and may well emulate.

1,000 Daily Output Planned for "Star"

**Predicted Production Facilities
Alone Will Limit Sales—Or-
ders for June Delivery**

NEW YORK, March 13—The new Star which was unveiled at Washington last week and which will be shown at Boston this week in the show rooms of the Collins Motor Car Co. already has created a considerable sensation in the automotive industry. Keen observers have no hesitation in saying that its sale will be circumscribed only by production facilities.

It is the ultimate purpose of Durant Motors Inc. to turn out 1000 a day and the Star will provide the first real competition Henry Ford ever has had.

Standard Parts Used

The question of service has not been neglected. The car will be built entirely of standard parts which will be available within a few hours in any section of the country. These parts will be carried in stock in the chains of parts service stations and sub-stations which are being established by the leading unit parts makers either individually or in groups. This service, with that which will be supplied by the dealers, will be entirely adequate, it is felt.

Parts makers, their plants and personnel have played an important part in the development of the Star. It is understood that it was the original idea that they should have some share in the making or distribution of the line, but it now is stated that they are to have no financial interest in the enterprise except as an outlet for their products.

It can be said, however, that the manufacturers of all the units which will be used are co-operating to the fullest possible extent. The first step in this direction was in setting prices which would permit the assembling of such a car at such a price. The second step was in arranging for uninterrupted and adequate production facilities. It now is believed there will be a steady flow of materials to the factory.

Financing Production

Fundamentally, although not actually, the parts makers may be said to be financing the enterprise. In other words, no large expenditure of capital by Durant Motors apparently will be necessary. For example, suppose enough parts to turn out 1000 complete cars are shipped this week by the various purveyors. Within another week these supplies will be at the factory. They will be assembled into complete vehicles and shipped with bills of lading attached within another week. The bills of lading will be deposited in the bank, and Durant Motors will be able to discount its bills.

129,500 CARS AND TRUCKS MADE IN FEBRUARY: IS 44 PER CENT INCREASE OVER JANUARY

NEW YORK, March 14—Production of passenger cars and trucks by all makers for February is estimated at approximately 129,500. This was an increase of approximately 39,000 or about 44 per cent over January. The monthly production figures since June, when they first became available, follow: July 176,336, August 180,781, September 158,314, October 147,544, November 116,349, December 78,995, January 90,486 and February 129,500.

February shipments of passenger cars and trucks, including driveaways converted into carload equivalents, were 215 per cent of February 1921. Factory shipping figures for the first two months of 1920, 1921 and 1922 follow:

	Carloads			Driveaways			Boat		
	1920	1921	1922	1920	1921	1922	1920	1921	1922
January	20,057	6,485	15,241	29,283	3,185	7,397	....	93	154
February	25,505	9,986	19,600	43,719	7,507	9,950	....	99	169

This condition prevails, however, with any company turning out a car in which only specialized parts are used. The parts makers really finance all these manufacturers. It means that these car builders are not required to expend large sums in building and equipping factories. No overhead expense of this character is necessary. With parts bought in huge quantities at the prices Durant is getting, the ultimate cost probably will be less than it would be if he made all of them himself.

In connection with this car, which will compete only with Ford and which is expected to sell in very large quantities, the parts makers can well afford to make a low initial price because of the parts replacement business which will come to them eventually through service stations.

Parts makers insist that their relations with Durant in this respect will be no different than with the builders of other specialized vehicles. They deny emphatically that they have entered into any formal combination. Those in the group which have arranged for the establishment of a chain of service stations point out that these stations also will be available to persons using any vehicle in which these parts are used. They insist that they regard Durant only as another customer.

(Continued on page 639)

Bethlehem Stockholders to Investigate Failure

ALLENTOWN, PA., March 13—An organized effort to save something from the wreck of the Bethlehem Motors Corp. was decided upon at a meeting here of New York and Allentown stockholders. Although the session was secret, it was announced that Alexander A. Bibighaus had been elected chairman and given power of attorney to prosecute if it was found anyone was criminally responsible for the \$2,000,000 failure.

The company was founded by Martin E. Kern, who later purchased the German interests in the Bosch Magneto Corp. and who now is in Europe. Clinton E. Woods, a former New York photographer, who was appointed receiver, said in his latest report that the liabilities were about \$2,400,000 and that there was small prospect of a dividend exceeding 20 per cent.

Executives Consider Site for Frontenac

**Detroit Makes Overtures—No
President Selected, But Di-
rectorate Is Increased**

INDIANAPOLIS, March 10—Allan A. Ryan, chairman of the board of directors of the Frontenac Motor Car Co., and W. N. Thompson, also a director of the new company, as well as the president of the Stutz Motor Car Co. of America, spent yesterday in viewing and inspecting proposed plants for the manufacture of the Frontenac.

Two extensive industrial plants are said to be under consideration for the home of the car, but it is said that no definite selection has been made. Thompson's interests in the new company are expected to be the determining factor in locating the company here, despite overtures from Detroit.

To Continue Temporary Offices

During the formative period the temporary quarters in this city will be continued. This is a plant with which Louis Chevrolet, designer of the car and vice-president of the company, has been identified. No president has yet been selected, but additional directors have been announced. One of these is Kenneth Howard, New York capitalist, who is listed as secretary-treasurer. William Rand, Jr., also of New York, has been named to the directorate. It is said that several men of prominence in local automotive circles will likewise be identified with the organization.

What is said to be the first experimental car went through trials on the Speedway yesterday, Louis Chevrolet driving.

It is reported that all the major units that will go into production, which is hoped to be on a large basis, will be built here. It is emphatically stated that the job will not be an assembled one. Although no figures as to the list price of the car are being quoted at this time, spokesmen for the company say that the organization will give the city a passenger car built in a popular price class that will necessitate quantity production.

Sharp Upward Turn Is Noted in Sales

Dealers Are Encouraged and Factories Feel Effects of Their Optimism

By JAMES DALTON

NEW YORK, March 14.—Production of passenger cars and trucks for February showed a material increase over January. The gain probably was as large as that of January over December, which was about 40 per cent, exclusive of Ford. Output was very much larger than in February, 1921.

Highly optimistic reports in regard to the volume of orders received continue to come from Detroit. They are accompanied by announcements of increased production. Several companies, including Dodge with 600 a day, Maxwell with 200 a day, Studebaker 400, Cadillac 100, and Hupmobile are approaching maximum production. Ford is speeding up his output both at the Ford and Lincoln plants. Chevrolet has fixed a schedule which calls for an output of 50,000 by July. The Rickenbacker is going into quantity production and the output of Durant fours is being speeded up as rapidly as possible. Other companies which are increasing their schedules are Reo, Paige, Dort, Columbia, Liberty and Wills.

Employment Improves

Employment in Detroit has shown a steady increase week by week since the close of the inventory period after Jan. 1. Employment in automotive plants is slowly but steadily increasing in all parts of the country.

There has been a sharp upward turn in sales at retail, both cars and trucks, in all sections. As a consequence dealers have been greatly encouraged and their optimism has been passed along to the factories. March always marks the real opening of the spring selling season, however, and April was one of the best months last year.

Predictions made in some quarters that the four months ending June 1 may establish a record for production undoubtedly are exaggerated although the volume of business will be large. The industry is establishing itself on a solid foundation for a long period of moderate prosperity. Notwithstanding a belated reduction here and there, it is evident prices have been fairly well stabilized. They are not likely to move sharply in either direction for several months.

While it has been expected that cultivation of the agricultural districts for sales in the fall would be profitable,

this market for automotive products is producing business on a moderate scale months earlier than had been anticipated. Demand is becoming apparent for cars in the lower price classes and for light delivery trucks.

Business of parts makers naturally is reflecting the better tone apparent in the vehicle building field and the scope of operations is being steadily expanded. The same is true in tire plants where production costs have been lowered by greatly increased labor efficiency.

Financial Position Stronger

In spite of very heavy losses taken on inventories, the financial position of the industry at this time is stronger than was believed possible a few months ago. No important companies are in serious difficulties.

Every effort has been made to reduce liabilities and an enormous sum has been paid in the aggregate on bank loans and merchandise accounts. While the loss of \$38,000,000 by General Motors on the year's operations seems exceedingly heavy, that corporation is in reality in a much stronger position today than it was a year ago and a very satisfactory profit for this year is assured.

Kentucky Wagon Plans for Merger Are Maturing

LOUISVILLE, KY., March 13.—Details in the transfer of the Kentucky Wagon Manufacturing Co.'s properties of the Associated Motor Industries, Incorporated, are expected to be completed and operations begun at the Louisville plant under the new arrangement within thirty days, James R. Duffin, attorney for the company, said last night.

Twelve or fourteen large automobile companies will be in the new corporation. Those united in the merger which have not yet made their conveyances are preparing to do so, according to Duffin.

The stock division in the new corporation will be \$40,000,000 shares of preferred and \$40,000,000 shares of common.

The Wagon company's executive committee in charge of reorganization plans yesterday sent out notices to creditors to obtain formal consent to go into the consolidation, and their approval of the arrangement.

INSURANCE FIRMS DISSOLVED

NEW YORK, March 13.—A Supreme Court order has been signed directing the State Superintendent of Insurance to take possession of the Motor Car Mutual Fire Insurance Co. and the Motor Car Mutual Casualty Co. It is alleged that the companies are insolvent and that the management has been guilty of misconducting the business. The court order dissolves both companies.

Schuette Transfers German Air Patents

Acquired by New American Corporation—Plans Developed for Commercial Lines

WASHINGTON, March 13.—Announcement is made by Dr. Johann Schuette, president of the Schuette-Lanz Airship Co. of Germany, that he has signed contracts giving the General Air Service Co. the manufacturers' rights and patent interests of the Schuette-Lanz airships for the entire world. This contract is expected to result in the virtual transfer from Germany to the United States of the large rigid airship building industry.

The General Air Service, which recently was incorporated for \$50,000,000 under the laws of Maryland, plans to start service with two large passenger and express carrying airships between New York and Chicago. The service ultimately will be extended to the Pacific coast and possibly to South America and Europe.

Two new Schuette-Lanz airships are to be designed for the General Air Service Co. Tubing and some other materials will be fabricated in Germany, but the ships will be assembled in this country where other materials will be made. Promoters of the company assert that these dirigibles will use helium instead of hydrogen gas and oil instead of gasoline to drive the engines. In discussing helium, Dr. Schuette said:

Schuette Discusses Helium

It will be unnecessary to change the construction of rigid airships to permit the use of helium. Helium has 92½ per cent of the buoyancy of hydrogen. The guarantee of absolute safety from explosion and conflagration leaves out of consideration the small loss in lifting capacity.

It is perfectly feasible to valve helium, when necessary, by compressing it into retainers, and letting it escape back into the bags as the operating requirements dictate. In that manner the helium will not be lost.

It is one of nature's great favors that the United States seems to be the one country supplied with helium in sufficient quantities to make its extraction economical. This is as it should be, because the extent of the United States within its own continental limits is so enormous that rigid airships are a prime factor in its air navigation. They are essentially long-distance craft, and not economical for routes less than 500 to 700 miles in length.

STABILIZING CONFERENCE

WASHINGTON, March 14.—Exhaustive inquiry into methods of stabilizing industry is to be made by representatives of trade associations who will meet in Washington next Tuesday with members of the United States Chamber of Commerce, the Department of Commerce, and the Committee of the President's Conference on Unemployment. The purpose of the investigation is to find a solution as far as possible of business depressions and practical means to prevent them.

Studebaker Reports 1921 Largest Year

Net Sales Aggregated \$96,690,644
with Profits Available of
\$10,409,601

NEW YORK, March 11—The profits earned by the Studebaker Corp. in 1921 were the largest in the history of the company, according to the annual report submitted to the stockholders. Sales showed an increase despite the depression of the year.

Net sales for 1921 totaled \$96,690,644, as compared with \$90,652,362 in the year previous. Net profits available for the common and preferred stock aggregated \$10,409,601. The balance available for the common shares was \$9,723,091, or the equivalent of \$16.20 a share on the \$60,000,000 common stock outstanding. In 1920 the corporation earned \$15.20 a share on the common stock.

Record Year for Sales

The company established a record in its history in the number of sales made, the total reaching 66,643 cars, which was a gain of 29.5 per cent over 1920, when 51,474 sales were made.

After the payment of all dividends, \$5,523,691 was added to profit and loss surplus, increasing that item to \$18,279,744. The surplus at the close of 1920 was \$13,467,048. Total current assets were \$38,974,732, and net current liabilities \$10,248,395.

The detailed income account for 1921 and 1920 is as follows:

	1921	1920
Net sales.....	\$96,690,644	\$90,652,362
Cost of mfg., etc.....	84,158,347	78,521,555
Net earnings.....	\$12,532,297	\$12,130,807
Interest received.....	138,149	120,014
Net profit.....	\$12,670,446	\$12,250,821
Excess profits taxes	2,260,755	2,428,767
Bal. for dividends....	\$10,409,691	\$9,822,054
Preferred divs. 7%..	686,000	710,150
Bal. for common.....	\$9,723,691	\$9,111,904
Common dividends 7% ..	4,200,000	3,937,500
Surplus	\$5,523,691	\$5,174,404
Previous surplus.....	9,882,048	20,925,583
Total surplus.....	\$15,345,739	\$26,099,987
Transfer to special surplus account....	405,000	405,000
Net losses 1921 anticipated, etc.....	719,995	872,940
Stock dividends.....	.....	15,000,000
Total deductions.....	\$1,115,995	\$16,277,940
Final surplus.....	\$14,229,744	\$9,822,048
Spec. surp. account..	4,050,000	3,645,000
Total surplus and special surplus.....	\$18,279,744	\$13,467,048

Looks for Better 1922

A. R. Erskine, president of the company, in his remarks to stockholders said: "The management believes that business this year will show a substantial increase over that of last year." Production schedules, it was said, called

CLARK EQUIPMENT CO. OFFERS POETS \$1,000

BUCHANAN, MICH., March 13 —The Clark Equipment Co. which dedicated to the automotive industry last year 12 paintings by eminent artists, depicting "The Spirit of Transportation," now has offered a prize of \$1,000 for the best poem or ode on the same theme.

The company proposes to publish full color reproductions of the series of paintings, accompanied by a suitable poem or ode. The board of judges which will award the new prize will be composed of Glenn Frank, editor, Century Magazine; William Stanley Braithwaite, editor, "Anthology of Magazine Verse"; Merle Thorpe, editor "The Nation's Business"; Frank W. Roche, publisher, "Automobile Topics"; Samuel O. Dunn, editor, "Railway Age"; Harold L. Brown, editor, "Bus Transportation."

Full details of the competition and a registration blank may be obtained by addressing the Clark Equipment Co., Buchanan, Mich.

for shipment of 25,000 cars for the first quarter of this year, compared with 11,620 in the first quarter of 1921.

Erskine further said:

The inventories of the automobile division at the beginning of the year amounted to \$26,853,948, including 2,932 finished cars. At the end of the year these inventories had been reduced to \$21,872,885, including 4,507 finished cars.

On Dec. 31, 1921, there were 1,301 preferred and 5,959 common stockholders, as compared with 1,254, and 6,591 respectively on the same date of the previous year.

Last year the average number of employees on the corporation's payroll was 13,065 as against 13,583 in the previous year.

Detroit Exchange Hears Good Report on Columbia

DETROIT, March 9—Columbia Motors Co. has orders on hand for 4000 new light six cars for delivery before July 1, members of the Detroit Stock Exchange were told yesterday at a special meeting staged by advertising counsel of the company. This action was taken to establish the position of Columbia stock on the local exchange, which has shown steady gains in the past two weeks.

The brokers were told that the new manufacturing plans of the company have been approved by financial interests and that production plans were complete. Distribution contracts were declared to have been placed already in 20 important centers.

Columbia, it is understood, will specialize on the manufacture of the new light six model and will discontinue its other lines as rapidly as its manufacturing and merchandising policies warrant.

White Takes Losses; Position Is Strong

Reduction in Inventories Entails
Charge of \$2,048,023—President Sees Good Year

CLEVELAND, March 11—The White Co. reports a loss of \$2,346,824 in its operations during 1921, but notwithstanding this it entered the new year in a strong position in respect to cash, inventories and back debts. The purpose of writing off losses on inventories entailed a charge of \$2,048,023, which, with manufacturing loss and interest, made the full loss of the year \$4,837,319.

The company paid \$2,000,000 dividends, taking the money from surplus. The full charge against surplus was \$6,837,319, bringing that item in the balance sheet down to \$2,661,663. Chiefly through a decline of inventories, working capital was reduced in the year from \$20,692,277 to \$14,431,931. The bank loans were cut in two, as shown in the following table of income and balance sheet items, the loans being carried as notes payable:

	1921	1920
Sales	\$30,320,948	\$51,998,122
Loss	2,346,824	*3,486,704

ASSETS

Inventories	\$13,351,452	\$22,989,073
Cash	1,346,441	1,472,329
Accounts receivable..	2,838,393	4,869,038
Notes receivable.....	2,571,731	2,026,976

LIABILITIES

Notes payable.....	\$3,600,000	\$7,200,000
Reserved for cont....	1,000,000	2,000,000
Surplus	2,661,663	8,472,312

*Profit from operations.

The usual quarterly dividend of \$1 a share was declared yesterday, payable March 31 to stockholders of record March 21. Walter C. White, president, said after the directors' meeting that the business outlook was favorable, orders having shown a marked increase since October.

FEDERAL SALES \$3,268,468

DETROIT, March 11—Federal Motor Truck Co. for the year ended Dec. 31, 1921, reports total sales of \$3,268,468, compared with \$10,628,742 in the previous year, giving net profits of \$176,800 against \$745,879 in 1920, the latter figure being subject to an estimated Federal tax of \$200,000. The comparative balance sheet shows cash in 1921 of \$165,301 against \$163,293 in 1920; receivables, \$256,209 compared with \$228,811 and inventories of \$1,521,050 against \$2,497,398. The liabilities include accounts payable of \$104,440 in 1921 as against \$352,734 and dealer deposits of \$23,985, compared with \$31,844 in 1920.

NEW GOODRICH TIRE

AKRON, March 11—The B. F. Goodrich Rubber Co. has a new model "55" clincher tire made in 30 x 3 and 30 x 3½ sizes only. The larger of the two sizes will retail at \$10.90.

British Overland Sustains 1921 Loss

Inventories, However, Were Reduced Substantially—Cash on Hand Greatly Increased

LONDON, March 4 (*By Mail*)—Crossley Motors, Ltd., of Gorton, Manchester, builder of Crossley "25" and "10.6" cars and, for a short time, a British Bugatti model, reports a trading loss for the year ended Oct. 31 of £234,965 gross and £224,296 net against a profit of £35,643 in 1920. The bulk of the common stock is held by Crossley Brothers, Ltd., which accentuates that company's loss on its year's business.

Willys-Overland-Crossley Co., representing the Anglo-American fusion since 1919, lost £96,486 gross and £84,275 net in 1921 against a profit of £112,210 in 1920. The stock price at date of issue was 21s. 6d. per share; it has dropped to 6s. 6d., or more than 62 2/3 per cent. Nevertheless the prospects of this company appear better than those of Crossley Motors, Ltd., because while on Dec. 31, 1920, inventories stood on the books at £708,697, they had been reduced last December to £348,602, and cash on hand was increased from £295 to £206,251.

Crossley Brothers, Ltd., is an old-established maker of oil and gas engines. In 1920 it made a profit of £59,112 plus £42,681 brought in from the previous year, and carried forward £51,161. The latest year's report shows a loss of £94,916 gross and of £42,855.

Truck Firm's Loss

LONDON, March 4 (*by mail*)—Halley's Industrial Motors report a loss on last year's trading. This is attributed to the dumping of many thousands of surplus Government trucks, often sold at prices barely more than the cost of freight for new vehicles. The company, anticipating a revival in trade, has increased its range of vehicles to various carrying capacities between 2 and 6 tons.

Hupp Motors Places New Order for 10,000 Bodies

RACINE, WIS., March 13—Industrial conditions in this city, which is one of the principal automotive production centers in the West, are reported to be improving markedly, considering the stagnation of recent months. Racine produces passenger cars, trucks, tractors, engines, parts, farm operating equipment and similar commodities with world-wide reputations, so that this present betterment of conditions is regarded as significant.

The H. & N. Body Corp., which started work Jan. 1 on an order for 10,000 bodies for the Hupp Motor Car Co., has received a supplementary order for another 10,000 bodies, delivery on the 20,000 to extend over 1922. In addition the concern has substantial orders from the Mitchell Motors Co., Racine. The H. & M. com-

MILWAUKEE DECLINES TO BUY ARMY SURPLUS

MILWAUKEE, March 13—Opportunities and offers to purchase army motor truck equipment from salvage or other sources have been declined by the city of Milwaukee in consideration of the question of providing twelve additional trucks of various types for municipal departments.

A special committee of the common council reported that the experience of other cities with army trucks was not satisfactory. Of the 173 motor vehicles of all kinds now in service in Milwaukee municipal departments, not a single army truck appears.

pany is owned by the Hupp and Mitchell corporations, from which it derives its name. It is employing 650 people and part of the plant is on an overtime schedule. Skilled workers are being employed in the metal finishing department as rapidly as they present themselves.

The Harvey Spring & Forging Co. has taken contracts for furnishing all springs for the Nash Six and Four, the Mitchell and the Case for the current season, and is gradually increasing its force of 175.

International Truck 1921 Profits, \$126,931

NEW YORK, March 14—The International Motor Truck Corp., for the year 1921, reports net earnings of \$126,931 after all taxes, interest and inventory adjustment. This is equal to \$1.16 a share on its first preferred stock, against \$2,644.013, or \$3.98 a share on the common, in the previous year. The sales for 1921 reached a total of \$24,849,268, as compared with \$34,071,365 in the previous year.

The balance sheet as of Dec. 31 last shows profit and loss surplus of \$9,258,700, against \$10,323,422 at the close of 1920. Accounts receivable were \$5,639,901 against \$3,472,348. Inventory was valued at \$9,675,583 against \$15,588,848.

President A. J. Brosseau, in his remarks to stockholders, stated: "Orders on hand and prospects for business justify the belief that the sale of Mack trucks during the coming year will be at a greater rate than in 1921."

PARISH & BINGHAM CORP.

BOSTON, March 13—The Parish & Bingham Corp. reports for the year ended Dec. 31, last, a total operating deficit of \$356,000 against \$262,296 in 1920.

The net sales in 1921 reached a total of \$4,201,124 compared with \$9,128,443 in 1920. The cost of sales was \$4,037,468 in 1921 and \$9,089,813 in 1920, leaving an operating profit of \$163,656 in 1921 and \$38,630 in the previous year.

The deficit after dividends was \$356,080 in 1921 and \$712,296 in 1920.

Chandler Profits for Year Decline

Inventory Was Reduced Materially, Annual Report Shows—Ample Surplus Helped

CLEVELAND, March 11—Chandler Motor Car Co. for the year ended Dec. 31 last reports gross profits on sales after deducting cost of material and manufacturing expenses, etc., of \$1,890,319 as compared with \$9,440,326 in the previous year, net income of \$41,017, equal to 14 cents on the 280,000 common stock of no par value, against \$4,213,111, or \$15.04 in 1920, and a deficit after dividends of \$1,918,983, as compared with a surplus of \$5,588,111 in the previous year.

The balance sheet as of Dec. 31 last shows cash \$538,448 against \$949,791 on Dec. 31, 1920; accounts receivable, \$131,845, compared with \$492,474; inventory, \$2,773,742, contrasted with \$5,788,504, and total assets and liabilities of \$13,255,570 against \$16,611,509.

Many Economies Effectuated

In his remarks to the stockholders, President F. C. Chandler says:

The year 1921 was the only year since starting business that found the company with an excessive inventory and a large stock of cars in hands of dealers.

We were fortunate that prior to this depression we had built up a surplus fully ample to carry business through a period of this kind and maintain a strong financial position. We effected many economies and were able to make extensive reductions in overhead expenses to permit us even with limited operations to carry on business with a fair operating profit.

All our financing has been done without aid of any large amount of borrowed money, and recent improvements in business, especially since Jan. 1, have been such that all current obligations at Dec. 31, 1921, have been paid, that portion of taxes which became due also was paid, and bank loans reduced by \$500,000 to date of this report.

Second Offering Ordered for Obenberger Property

MILWAUKEE, March 13—A second offering has been ordered made on March 20 of the property of the bankrupt John Obenberger Forge Co. at West Allis, Milwaukee County. But one bid was made at the first public auction conducted by J. F. Gerdis, trustee, this being by Adolph H. Weidner, attorney, on behalf of secured creditors, in the sum of \$233,000, which the bankruptcy court ruled as inadequate to cover assets appraised at \$955,242.

The Weidner offer was to pay \$48,000 in cash and assume liens aggregating \$185,000. The explanation was that under present industrial conditions the assets have a market value far below the real worth. The liabilities of the Obenberger company are estimated at approximately \$800,000.

Higher Tire Prices Predicted at Akron

Manufacturers Say Upward Revision Will Do Much to Stabilize Market

AKRON, MARCH 13.—Predictions that tire prices will be increased within the next 30 or 60 days are being made by Akron manufacturers. They contend that a study of balance sheets of tire companies will disclose plainly why higher prices are necessary and will afford justification for them.

Manufacturers contend that an upward revision would do much to stabilize the market and disabuse dealers generally of the erroneous impression that another reduction is in prospect.

The downward trend of tire prices, started last May by the B. F. Goodrich Co. and quickly followed by practically all large and small competitors, brought reductions which made tire prices at the end of the year 1921, approximately 40 per cent lower than at the beginning of the year. The new prices were also lower than before the war, and lower than in 1910, with the 1921 tire producing twice the mileage of the 1914 tire and three times the mileage of the 1910 tire, thus giving the motorist more tire miles per dollar than ever before.

Operating Costs Lowered

Scarcely had the last of these price reductions taken effect, than the price of raw materials used in tire manufacture began steadily to climb. The tire companies were forced to make drastic cuts in operating and overhead expenses. Office forces were pared to the bone. Sales forces were greatly reduced, territories were expanded and salesmen were compelled to "double-up." Finished goods inventories were also reduced to the lowest point for many years. In many factories the finished goods inventoried in the latter part of 1921 were smaller in tire units than the number of tires these same companies the year before had kept in transit.

Manufacturers claim the steady climb upwards of raw material prices, coupled with the absolute fundamental necessity for increased revenue so as to avert deficits in 1922 and so as to permit resumption of dividend payments, make the contemplated price increases justifiable. Forces can be reduced no further. Factory forces are down to rock bottom. All poor workmanship has been weeded out and only the most proficient tire builders have been kept. This has increased efficiency to a large degree but has not been sufficient of a saving to the companies in wages, to offset the 40 per cent reduction in gross sales revenues as occasioned by price cuts last year.

SUES PORTAGE STOCKHOLDERS

AKRON, March 14—Thirty-nine stockholders of the bankrupt Portage Rubber Co., now the property of the Seiberling

Rubber Co., have been sued by W. E. Young as attorney for George D. Bates of Akron, trustee in bankruptcy, for a total of \$46,000, said to represent the unpaid portions of their subscriptions for Portage stock prior to the company going into receivership. The amounts being sued for range from \$400 to \$4,800.

Miller Rubber 1921 Sales Gain But Profits Decline

AKRON, March 14.—Although sales of the Miller Rubber Co. for 1921 showed a 5 per cent increase in volume over sales of 1920, the Company reports a net loss for 1921 of \$91,986 and a total deficit on Dec. 31, 1921, of \$1,290,604 according to the annual statement and balance sheet given to stockholders at their annual meeting here.

While sales in volume exceeded those of 1920, in gross revenue, due to the series of tire price cuts enforced last year, 1921 tire sales were only \$18,983,677 as compared to \$26,182,391 in 1920.

The company, according to the annual balance sheet, reduced its inventories from \$9,321,803 to \$3,981,922. After writing down its inventories and deducting an amount considered adequate to cover doubtful accounts, discounts and contingencies, the current assets of the company amount to \$7,983,224 less current liabilities of \$2,060,437 (all bank indebtedness being paid), which gives the company approximately \$5,922,237 net working capital or 31 cents on each dollar of the net volume of business the company did last year, according to President Jacob Pfeiffer.

Brighton Mills Sued for Seiberling Stock

AKRON, March 13—Suit to gain possession of \$45,000 worth of stock in the new Seiberling Rubber Co. has been filed in the Summit County common pleas courts in Akron against the Brighton Mills Co., a New Jersey corporation, by the By-Products Realization Co. of Chicago.

The By-Products company alleges that the Brighton Mills Co. was a creditor of the Portage Rubber Co. of Barberton which has been acquired by the Seiberling Rubber Co. and that the defendant company owed the plaintiff \$45,000 for services rendered last year. It also sets forth the claim that the Brighton Mills Co. agreed to pay the plaintiff in Seiberling stock, which it received in settlement of its claims against the Portage Rubber Co., and that payment has been refused.

BRADY LEAVES AUSTIN

LONDON, March 1 (*By Mail*)—Sir Reginald Brady, former secretary of the War Office, has resigned from the board of the Austin Motor Co., Northfield, Birmingham.

Gordon McGregor, Ford Executive, Dies

**Head of Canadian Company —
Succeeded Father as Walkerville Wagon President**

DETROIT, March 13—The plants of the Ford Motor Co. both in Detroit and Windsor will be closed to-morrow when the funeral of Gordon M. McGregor, president of the Ford Co. of Canada, will be held. McGregor died Saturday. He was 40 years old and had served for almost 20 years as president of the company which he organized in 1903.

McGregor succeeded his father as president of the Walkerville Wagon Works in 1903. The company was in financial straits and McGregor interested Henry Ford in forming a Canadian branch of the Ford Company to take over the Walkerville Wagon plant. A company was capitalized at \$125,000 with rights to sell in all parts of the British Empire, except the British Isles. Ford for his patents and sales rights received 51 per cent of the stock. This has since been reduced to about 20 per cent.

The plant began operations in 1904. In the second year only 110 cars were manufactured and of these 76 were exported. Then business boomed. In 1911 the capitalization was increased to \$1,000,000 and in 1916 to \$10,000,000. Employees now number 14,000.

No time has yet been set for the directors to act upon the death of McGregor. Wallace R. Campbell, secretary, assistant treasurer and assistant general manager, is looked upon as the most likely successor.

R. & V. Motors Opens Branch at Its Factory

EAST MOLINE, ILL., March 13—In line with the success of its retail branches in Chicago, Boston, Baltimore and other automobile trade centers, the R. & V. Motor Co. has opened a factory retail sales and service department, adjoining its main factory building. B. N. Ward and D. S. Smith are in charge.

Reports from branches and distributors, officials say, indicate a 1922 business eclipsing that of 1921, when the R. & V. plant was one of four manufacturers whose sales exceeded 1920 and second only to one other in higher percentage of increase.

The factory is now working full time with practically a normal force, and production is at a rate greater than last year.

LOWER PRICED WASHINGTON

EATON, OHIO, March 11—The Washington Motor Co. has stopped production on the light six model priced at \$1,635 and is at present working on a design for a lower priced car to sell for about \$1,275. The heavier model is being continued.

Milwaukee Reports Better Conditions

Car Manufacturers Increase Delivery Specifications on Standing Parts Orders

MILWAUKEE, March 13—A slight but gratifying increase in delivery specifications on standing orders held by Milwaukee automotive parts manufacturers from the various passenger car factories has been a feature of the past week's business. Some new orders placed likewise have brought about a better feeling.

During January and February parts makers were just about able to hold their own in the matter of production, but it appears that since the national and local winter shows have portrayed the possibilities of demand, and the effect of the local shows has been to increase retail sales, which has been reflected into distributors' orders, car builders are proceeding on a broader basis.

There is nothing particularly striking or sensational about the present improvement in the local parts industry, save that it means a recovery from a sort of trough into which it found itself during the between-season period from the holidays until the beginning of March. A survey of the general situation of Milwaukee industries, wholesale and retail business, indicates that lost ground is steadily being regained. Unemployment is again being relieved, especially in the general iron, steel and machinery trade.

Local Trade Better

Although here and there comes a fresh jolt in the form of a new price reduction announcement by passenger car manufacturers, the demand here is making progress and dealers believe that a point has been reached where the position of prices may again be called stable, or nearly so.

Those handling the makes within a range from \$950 to \$1,500 are now doing a better business than at any time since last July or August, judging by sales so far in March. The higher priced lines, who were relatively more active than others in the last four or five months, are holding their own. Ford dealers report gains, with prospects more inclined to close pending deals.

Prospective buyers still have something to learn about the obvious pursuit of used car values in relation to new car prices at the reductions which have been made, but the lower level of used car allowances is gradually becoming better understood.

IMPLEMENT EXPORTS GAIN

WASHINGTON, March 10—Exports of agricultural implements and tractors for the first month of 1922 show an increase of \$314,208 over the month of December, 1921, according to a special report by the Agricultural Implement Division of the Department of Commerce. There is reason for encouragement in the

FORD WILL PRODUCE 400 TRACTORS DAILY

DETROIT, March 13—The Ford Motor Co. will increase its tractor production to 400 daily in April, thereby doubling the present output. All parts of the country are represented in the increased business, the distribution being through the regular channels. Production of cars and trucks is 34,000 ahead of production last year at this date. January assembly at the plants approximated 40,000, against 30,000 last January. February production was 52,649, compared with 30,305 last year.

fact that the statistics for January indicate an upward trend of exports. The chief decrease in January, 1922, as compared with January, 1921, when the total exports were \$7,320,277, was in plows and cultivators, and mowers and reapers.

Trade Reviving in West, Cadillac President Wires

DETROIT, March 13—H. H. Rice, president and general manager of the Cadillac Motor Car Co., who is on a trip to the far West, wired the factory from Spokane, Wash., that even to the "ultra conservative" element indications of a business and trade revival are clearly discernible in the West.

"The more optimistic are outspoken in predicting very much improved business for about all the West," Rice reports, after analyzing the situation as he has seen it in Nebraska, Colorado, Montana, Utah, Oregon and Washington. His message continues:

Cattle, hog and sheep feeders are making good showings. The copper mines have opened after a long shutdown. Prices for all live stock and for wheat are much better. Shipments of lumber are greater than for months. Money is easier, and, best of all, people begin to feel that a distinct change for the better has really taken place.

The automobile business generally can expect a much better condition than in 1921, and Cadillac particularly will show a very substantial increase.

Durant Canadian Program Calls for 12,000 Output

TORONTO, March 11—The first car produced in the plant of the Durant Motors of Canada, Ltd., Leaside, was delivered to E. A. Wallberg, Toronto representative. The Leaside plant is now equipped and ready for quantity production and all cars to be absorbed by the Canadian market will be manufactured there. The present year's schedule calls for between 12,000 and 15,000 automobiles.

Within the next few days a considerable number of Durant cars, now in process of construction, will be shipped from the Leaside plant and distributed throughout the Dominion.

Credit Men Discuss Retail Time Sales

More Careful Selection of Dealers Suggested to Bring About Better Paper

NEW YORK, March 10—The cost of financing retail time sales cannot be materially reduced, except through the improvement of the character of paper sold to the finance corporations. This opinion was expressed by F. G. Rawson, vice-president of the Commercial Credit Co. of Baltimore, before a meeting of the Automobile Financing Credit Men's Association, which is allied with the National Association of Automotive Bankers.

Better paper will result through the education of the dealer as to the best way to sell on time and get paid for it, it was suggested, and through the more careful selection of dealers by the manufacturers. Under present conditions collection costs and the losses of revenue on delinquent payments are so high that it is impossible to reduce the rates.

Rawson favored the financing of the dealer's stock of cars by his own bank. However, he did not think that the dealer should use his line of bank credit for financing retail time sales. A further disadvantage is that the bank has no machinery for collection, and, in case of a delinquent payment, the note comes back to the dealer for collection. This is the thing the dealer wants to avoid and can avoid through the use of a finance corporation.

The types of instruments required for retail time selling in the various states due to the variations in legal practice were discussed by P. W. Haberman, vice-president of the Commercial Investment Trust Co. The conditional sale contract is used in all states except Ohio, Missouri, Colorado, Michigan, Louisiana and Pennsylvania. The chattel mortgage is used in all of these states except Pennsylvania, which requires the bailment form.

10 Carloads of Tractors to Be Shipped by Eagle

APPLETON, WIS., March 13—The Eagle Manufacturing Co., manufacturer of the Eagle tractor, has booked orders in the last two weeks for about ten carloads of tractors, four being for Canadian shipment and the others for Pennsylvania, Ohio, Indiana and Michigan.

According to Charles J. Hagen, general manager, indications are that present tractor prices will never be lower, and a material advance may be expected after June 1, by which time it is expected that the supply now on hand, which was carried over by manufacturers, will be exhausted and new production will be on a basis of present material, labor and manufacturing costs, as compared with present "pressure" prices. Hagen regards the outlook for the remainder of the year as good.

Offices of Chrysler Bear Maxwell Name

**Former Willys Executive Has
Mapped Out No Definite Pro-
gram for Future**

NEW YORK, March 14—Walter P. Chrysler has returned from a brief vacation at Palm Beach and opened offices in the Equitable Trust Co. building on Madison Avenue. The name on the door will be the Maxwell Motor Corp., of which he is chairman of the board.

Chrysler said to-day he had not mapped out a program for the future. He will devote a considerable share of his time to the affairs of the Maxwell and Chalmers companies, but also will give considerable attention to his own affairs, which have been neglected in the past two years.

While Chrysler does not propose to cast aside altogether business responsibilities, he does propose to rest a great deal more than he has for a long time. In addition to his duties as executive vice-president for the Willys enterprises, he had much of the responsibility for working out the reorganization of the Maxwell and Chalmers properties.

In connection with reports that Cleveland interests are negotiating for the purchase of the "Chrysler Six," which was to have been made by the Willys Corp., it was stated by Chrysler that he had withdrawn the right to use his name in connection with this enterprise and that while the receivers of the Willys Corp. can sell the engineering rights in this car, the name does not go with them.

New Zeder Motor Co. Advancing Car Plans

CLEVELAND, March 13—Royal T. Hodgkins, manager of the Cleveland Tractor Co. and one of several Cleveland business men who are interested in the new Zeder Motor Co., said to-day that definite plans are under way for the manufacture of a new car, which will be known as the Zeder, in the plant of the tractor company in this city.

Hodgkins denied that the new company, which has been incorporated under the laws of Ohio with a nominal capital of \$500, has under consideration the purchase from the Willys Corp. of the rights to the car which it was to have manufactured in its Elizabeth, N. J., plant.

It had been reported that preliminary steps to this end were being taken by Rollin H. White, president of the tractor company; Clement Studebaker, Jr., who severed his connection with the Studebaker Corp. ten months ago, and Fred Zeder, former chief engineer of the Studebaker organization and designer of what was to have been the Chrysler Six. It is stated, however, that Studebaker is associated with White in the new venture.

The car will be powered with an engine developed by Zeder.

WANTS NAME TO BRAND "JAY WALKER" DRIVER

WASHINGTON, March 14—The American Automobile Association wants a name that will brand reckless motorists just as "jay walker" brands careless pedestrians.

"A jay walker," it is explained, "is a person not sufficiently civilized to cross the street at the proper crossings. He or she endangers public safety as well as obstructing traffic. The jay walker deserves prosecution, but even more effective is the ridicule carried by the term."

A similar name is wanted for rowdy and careless drivers to show them that they do not "belong," and it must be as comprehensive and have the elements that will make it as popular in its use as its pedestrian brother.

The association offers a \$25 prize. The contest will close May 15 and the award will be made May 29. The Contest Editor is located at 1108 Sixteenth Street, this city.

Columbus Has New Firm to Make Truck Parts

COLUMBUS, March 11—The Bingham Manufacturing Co. has been incorporated with a capital of \$100,000 to manufacture special parts for trucks and to assemble trucks. The company has taken over the East Livingston Avenue plant of the Immel Co., body makers, which went into the hands of receivers some time ago.

New machinery is being installed. Many of the parts are patented and are designed for special jobs. H. N. Bingham is president and general manager; F. E. Kocher, vice-president, and G. P. Hinkle, secretary. Other incorporators are J. A. Shearer and James R. Spellman.

Agents Sign for Space at Show in Mexico City

MEXICO CITY, MEXICO, March 3 (By Mail)—Indications point to the success of the annual automobile show that will be held here, commencing April 16, under the auspices of the automotive division of the American Chamber of Commerce. W. F. Saunders, Jr., secretary of the chamber and likewise secretary of the show, stated to-day that fifteen agents already had signed up for space.

ALL METAL VALVE CO. FORMED

DETROIT, March 11—Articles of association of the All Metal Valve Co. were filed in this city yesterday, Frank L. Klingensmith, C. Malinz, Kansas City, and Frank F. Beall being shown as principal stockholders. The company is to manufacture a tire valve with a patented locking device. Capital stock is \$200,000, with 2000 shares at \$100 a share.

Bureau of Standards Revising Headlamps

**Values for Lights on Road In-
creased Under Agreement
with Society**

WASHINGTON, March 13—Revision of specifications for headlights on automobiles has been undertaken by the Bureau of Standards, in co-operation with the committee on Motor Vehicle Lighting of the American Illuminating Engineering Society. An agreement was reached whereby the values specified for lights on the road were considerably increased, while the limiting values, which are intended to control glaring lights, were left unchanged. Other changes were also made.

As many devices approved under the present regulations would not satisfactorily meet the requirements of the revised ones, it is probable that these specifications will only be recommended for adoption at some definite period in the future, presumably two or three years.

Reports received by the Bureau of Standards show that the establishment of headlight adjusting stations in garages has been a very desirable step toward uniformity of automobile lighting. Automobile manufacturers are very much interested in regulations governing headlights used on motor vehicles and are assisting the Bureau of Standards and legal authorities in the United States which have framed laws governing the use of headlights. The Bureau is particularly desirous that there should be uniform treatment in all states.

Uniform Laws Needed

In order to secure a satisfactory degree of uniformity in all parts of the country, it will be necessary to have (1) uniform laws, (2) uniform procedure in the enforcement of the laws, and (3) an extensive campaign of education both for enforcement officers and garage men and drivers of automobiles.

With the idea of securing uniformity in the adoption of such regulations, an informal organization of state authorities representing the whole of New England, New York, New Jersey, Pennsylvania and Maryland has been formed. Another meeting of this organization will be held at Harrisburg in April, and it is understood that an attempt will be made to establish a board of officers who will be charged with the approval of devices in all the states represented.

KNOX TIRE PLANT SOLD

MT. VERNON, OHIO, March 10—The plant, equipment and other property of the Knox Tire & Rubber Co. has been sold at public auction by Trustee Paul M. Ashbaugh to F. G. Litsch of Middletown, Ohio, representing a group of stockholders of the company. The property had been appraised at \$213,186 and was sold for \$175,000.

1,000 Daily Output Planned for Star

Predicted Production Facilities
Alone Will Limit Sales—Orders
for June Delivery

(Continued from page 632)

The situation in a nutshell is that the leading parts manufacturers are seeking the expansion of their markets by fostering the sale and development of specialized vehicles. They are eager to do anything within their power to balance so far as possible the output of assembled cars as compared with that of the builders who make most of their own units.

It is not to be denied that some of the parts makers have given consideration to the question of extending a certain amount of financial backing to certain assemblers whose product possessed large sales possibilities. There even has been talk of accepting a share of the profits of these companies, but this plan has been abandoned. There will be no formal combination, it is said, for the present at least.

While orders are being taken for June 15 delivery of the Star, detailed plans for its distribution have not been worked out, but it can be stated that the policy will follow closely that of the Ford company and that no exclusive territorial sales rights will be given.

Plant Location Not Determined

While all cars are being sold at Ford prices, f.o.b. Detroit, the location of the factory has not been definitely determined. The freight rate from the entire Michigan manufacturing district is the same as from Detroit. It is probable the first cars will be made at the Long Island City plant.

Although no definite plans have been made for the manufacture of the Star, it can be stated that Durant engineers have inspected the Elizabeth, N. J., factory of the Willys Corp. Durant has been favorably impressed by this modern plant, but for assembly purposes it would be worth only a fraction of what it cost, and there is nothing as yet to indicate that he will decide to buy the property.

As already announced, the distribution, sale and servicing of the car will be in the hands of a company to be known as the Star Motor Car Co. This will be a subsidiary of Consolidated Motors, a Maine corporation which will serve as a holding company. Consolidated Motors was incorporated three or four years ago, but has been dormant ever since that time and recently was reincorporated. It has 2,000,000 shares of common stock at \$10 par value. None of this stock will be issued to the public. It is assumed various other companies will be formed later as subsidiaries of Consolidated Motors. No information is available as to the stockholders either in the parent company or its subsidiaries.

N. A. C. C. RECOMMENDS CAUTIONS IN DRIVING

NEW YORK, March 14—The National Automobile Chamber of Commerce has suggested to manufacturers that they attach in some way to each car or truck sold the following cautions regarding the need for care in using motor vehicles:

1—Always remember you are an engineer, fully responsible.

2—Inspect your brakes at least once a month.

3—Never pass to the left of a street car.

4—Never pass a street car when it is stopping for passengers.

5—Always signal with hand when slowing down, turning or stopping.

6—Sound horn three times when backing.

7—Observe the traffic rules carefully; they are made for your safety.

26,840 Visitors at Washington

WASHINGTON, March 10—Actual count showed that 26,840 visitors inspected the new Star when it made its debut here. Durant expressed himself as highly pleased with the number and the interest shown. Salesmen declared that several hundred people had expressed their intention to purchase the car as soon as it has been put on the market.

R. H. Harper has been named distributor for this territory.

35,000 at Boston

BOSTON, March 14—Approximately 35,000 persons have viewed the new Star, Durant product, when it was shown in this city. It was stated that orders were taken at the rate of one a minute. The car will be taken from here to New York the last of this week for a brief showing.

Shaler to Build Larger Plant to Replace Old

WAUPUN, WIS., March 13—Arrangements to build a new plant on a scale exceeding that of the one totally destroyed by fire March 3 are being made by the C. A. Shaler Co., manufacturing vulcanizers, tire and rubber repair equipment, headlight lenses and other automotive specialties. Although the loss was a heavy one, only a part of the damage of \$300,000 to \$350,000 being covered by insurance, the company will engage immediately in the rehabilitation of its productive facilities.

C. A. Shaler, founder and president of the company, was in California at the time of the fire and wired instructions to R. B. Dunlap, secretary and sales manager, to proceed with reconstruction as early as possible.

French Compound New "National Fuel"

900 Parts of Gasoline Contained
in Mixture to Be Given
Competitors in Test

PARIS, March 1 (By Mail)—A mixture composed of 900 parts high-grade gasoline, 100 parts 95 degrees alcohol, 17.5 parts cyclo-hexanol, and 37.5 parts phenol, will be given to the competitors in the "national fuel" competition to be held near Beziers on April 2.

These trials, which form part of a big movement to secure home-produced fuel for France, consist of a 250-mile road test for all types of cars, which are given a determined amount of the above fuel according to their piston displacement and weight. The winner will be the one traveling the greatest distance on this allowance, while maintaining the minimum average speed required in his particular class.

The mixture adopted for the Beziers competition, and designated "national fuel," differs entirely from the "national fuel" recently put on the market by the Government. This latter is composed of equal parts of alcohol and benzol.

Benzol Stocks Depleted

One of the results of the Government action in marketing an alcohol-benzol fuel has been to remove all benzol supplies from the French market. This has caused dissatisfaction among motorists, and particularly among the big taxicab proprietors. The Department of Commerce has issued an official statement to the effect that the French production of benzol is only 800 tons per month, and practically the whole of this is used by the producers. Owing to adverse exchange rates, supplies cannot be obtained from England and America.

Under the terms of the Peace Treaty, Germany is obliged to deliver 2500 tons of benzol to France every month. The whole of this is monopolized by the Government for making its "national fuel," composed of 50 per cent alcohol, 50 per cent benzol. The Government is anxious to get this fuel on the market in order to exhaust its big stocks of alcohol, but is not meeting with much success. The Paris Omnibus Co. is using the Government fuel, but the taxicab companies and private owners refuse to have anything to do with it.

Cadillac, Detroit Founder, to Be Honored Annually

DETROIT, March 14—The celebration of the anniversary of Antoine De La Mothe Cadillac, founder of the city of Detroit, by the Cadillac Motor Car Co., proved to be so successful that it will lead to the institution of an annual Cadillac day by the company. Distributors throughout the country joined in the celebration.

Strike Will Retard South African Trade

Demand for Buses and Tires Forecast, However—Country Reports Good

JOHANNESBURG, UNION OF SOUTH AFRICA, Feb. 6 (*By Mail*)—The motor industry has not suffered as much from the coal and gold mining strike as was expected at the outset. In fact, the street cars in this city have been unable to operate for many days because of the lack of coal. Motor transport, therefore, has carried citizens from and to their homes. All types of motor vehicles have been in use, from heavy trucks to taxicabs and automobiles. This has resulted in reducing the stocks of tires on hand.

Johannesburg has never had many motor buses because the street cars, being operated by the municipality, have a monopoly. It is anticipated that after the present experience the municipality will order a number of buses in the event of any future tie-up in street car transportation.

Air Will Be Cleared

Following the present trouble, things are bound to be bad for some months and very few new cars may be sold. But it is thought that the strike will clear the air once and for all and put an end to the Rand's industrial strife.

Reports from the country districts are very encouraging and show that the farmers have more money to spend. For instance, Hupp Garages, Ltd., and the General Garage, Dodge Brothers agent, sold nearly as many cars in January as in the previous month despite the industrial situation. Most of these sales were in the country districts, although Johannesburg, Pretoria and Cape Town were responsible for a number of sales.

The 1922 Maxwell has arrived in South Africa and has been very favorably received. The Buick Four is still on the water and its arrival is awaited with interest. It is understood that a shipment of Nash Fours is also on its way. The Oldsmobile Four has met with a favorable reception and there have been a number of sales made in the coast towns. The latest model of the Hudson has arrived and there is no difficulty in disposing of the sporting models, which are great favorites in this country. Speedy cars are liked here despite bad road conditions.

More British Light Cars

A few more British light cars have been received and it is understood that others are on their way. These light cars, however, have a very limited market owing to poor roads.

American-made motorcycles find a market, although British machines are steadily gaining as the prices become lower. The Indian and Harley Davidson are the most popular of American makes and probably top the list of all motor-

cycles sold as regards quantity. The Excelsior is growing in popularity. The British A. J. S., Triumph, Matchless, Enfield, B.S.A., Coulson, Zenith, Douglas, and Norton are gaining in sales.

Car prices have been reduced considerably during the past month or two. Buick, Chevrolet, Ford, Hupmobile, Studebaker, Cadillac and Maxwell have all made downward revisions. Dodge Brothers have announced that a reduction retroactive to Jan. 1 will be forthcoming soon. While the Nash Six is still being quoted as during the war period, the price has always been far below that of its competitors.

M. EDWARD.

Marlin-Rockwell Corp. Organizes Subsidiary

NEW YORK, March 14—The Marlin-Rockwell Corp. has organized a subsidiary known as the Marlin Wire Wheel Corp. to take over the manufacture of the Rudge-Whitworth Wire Wheel, which has been manufactured under a license giving exclusive right to the use of that name in this country. The wheel has been manufactured heretofore by a division of the parent corporation, and it is believed formation of the new corporation will give impetus to sales efforts.

The Marlin Wire Wheel Corp. has as its president Guy Vaughn, who is president of the Standard Steel & Bearings Corp., another Marlin-Rockwell subsidiary, and general manager of the Philadelphia plant. H. C. Pryer is the secretary and treasurer.

New Soft Top Increases Demand for Closed Cars

DETROIT, March 14—The advent of the new soft top type enclosed car with its price differential of only a few hundred dollars from the open models, has brought the enclosed models into active demand, even with spring at hand.

Factories making the inexpensive enclosed models report a demand for these cars parallel with open model sales and in some cases exceeding them. The Essex, which was the leader in this field, is now paced by Hudson, Dodge and Hupp.

This demand has been so noteworthy that President J. D. Dort of Dort Motor Car Co. has made the statement that in his belief open cars will in the near future be almost entirely superseded by enclosed cars except in the cases of persons who keep more than one car.

JEWETT SEDAN AT \$1,395

DETROIT, March 11—A second Jewett model just announced by the Paige-Detroit Motor Car Co. is a four-door, five-passenger sedan and sells at \$1,395. All body panels are of steel. The joints are welded together over a framework of hardwood to form a seamless shell. This type of construction is said to permit the application of a standard finish to the whole exterior of the car.

All Models But One of Earl Are Reduced

Price Cuts Range from \$90 to \$200—Roadster Unchanged at \$1485

NEW YORK, March 10—Reductions of from \$90 to \$200 on the Earl cars and delivery wagons were announced here today by factory representatives. The new and old prices are:

	Old Price	New Price
Phaeton	\$1,185	\$995
Sedan and brougham....	1,895	1,695
Express delivery wagon	1,085	995
Panel delivery wagon...	1,160	1,060

The custom-built roadster remains unchanged at \$1,485, being the only model on the new Earl line that was not reduced. Extra charges of \$15 for radiator thermometer, windshield wiper and bumper are announced on the phaeton and \$30 extra for this equipment and heater and running board mats on the closed cars.

CHALMERS TO INCREASE \$100

NEW YORK, March 13—The Chalmers Motor Corp. will increase the price of its various models by \$100 on April 3. This increase will not apply, however, to the Maxwell models.

MERIT PRICES REDUCED

CLEVELAND, March 14—The Merit Motor Car Co. of this city announces today a price reduction from \$1,985 to \$1,895 for its five passenger phaeton and two passenger roadster.

DANIELS, \$1,000 LOWER

READING, Pa., March 14 — The Daniels Motor Car Co. has made a straight reduction of \$1,000 on all models of its line.

LOWER R. & V. PRICES

EAST MOLINE, ILL., March 15—The R. & V. Motor Co. announces a reduction of 10 per cent on the prices of the R. & V. Knight four and six cylinder models.

Irish Business of Ford Gains Under New State

DETROIT, March 15—Business of the Ford Motor Co. in Ireland has increased encouragingly since the establishment of the Free State. The company reports that Irish dealers forecast a much larger volume of sales throughout the year for Ford products. The plant at Cork is now furnishing cylinder blocks and other parts to the Manchester, England, plant, and it is stated that the Manchester product soon will be entirely British made.

Activities out of Manchester are expanding steadily, but sales in England have been confined largely to trucks and delivery vans, which are said, this year, to dominate the automotive field.

Exchange Retarding Trade with Hungary

Country Stands in Need of Motor Trucks—Market Also for Passenger Cars

WASHINGTON, March 11—The exchange rate in Hungary is practically the only drawback to the sale of American motor trucks in that country. A study of the situation by Vice-Consul D. A. Willson at Budapest shows that Hungary needs great quantities of motor trucks at this time to reduce transportation costs of essential commodities. He believes that medium priced trucks and passenger cars will find a ready sale as the exchange rate becomes more favorable.

Willson has produced figures showing that the supply of horses in Hungary has dwindled to about 37 per cent of the horses existing in 1918. Analysis of transportation costs showed that the cost of transport of one ton of merchandise by a 5-ton truck, with trailer attached, would amount to about 12 crowns per kilometer, as estimated by transportation men in Budapest.

Higher Rail Rates

The rate for transporting the same weight of merchandise by rail, without allowances for cartage and transfer, is 19 crowns per kilometer by fast freight, according to the Transport Tariff of the Hungarian State Railways, in force since August 1920—and a 100 per cent increase in rail rates is expected to be put in effect some time early in 1922.

The automobile manufacturing industry of Hungary has never prospered. It reached its highest point of productivity during the war when the government requisitioned plants for the manufacture of trucks for the army.

During the years from 1910 through 1920, the total number of motor vehicles manufactured in Austria was 2504, of which 409 were passenger cars and 2095 were trucks. These were the output of six factories, all of which manufactured trucks, but only four of which made passenger cars. One firm has not manufactured any motor vehicle since 1912; from 1915 through 1918 only one factory was making passenger cars and four or five were producing trucks; in 1920 four factories were operating, two manufacturing passenger cars and two trucks.

Scarcity of Raw Materials

It is believed that were it not for the difficulty of importing raw materials the Hungarian motor industry would be more successful, in view of the fact that the low rate of the crown and the corresponding low rate of wages would permit the exportation of cars to nearby countries with favorable results. However, at the present time the factories are working on a reduced scale because of the further fact that the transportation situation is most unsatisfactory, and there appears to be a general slump in the motor car market of Hungary.

The greater part of the motor vehicles used in Hungary are imported from other countries, and the business is carried on through the agents of foreign manufacturers. The first real influx of foreign motor vehicles began in 1905, due to the interest aroused by the Second International Motor Show held in Budapest during that year. Since that time the total importation of motor cars has been nearly four times as great as the entire domestic production.

About 85 per cent of the motor vehicles imported into Hungary, however, are never put into use in that country, but are re-exported to nearby countries. During the period from 1910 through 1920 the total number of foreign motor vehicles brought into Hungary and used in that country amounted to 784, of which 547 were passenger cars, 59 motor trucks and 178 motorcycles.

Report of Stewart-Warner Shows \$767,411 Net Income

CHICAGO, March 14—After writing down inventories about \$500,000 and making surplus adjustments, the net income of the Stewart-Warner Speedometer Corp. was \$767,411, according to the company's annual report. After payment of \$1,172,105 in dividends, there was a deficit of \$404,694, which resulted in the surplus being reduced to \$7,637,234 compared with \$8,041,397 at the close of 1920.

The report states that business thus far this year was about 100 per cent above the corresponding period last year, that a normal production basis was being rapidly approached and that a satisfactory profit was expected this year.

N. A. C. C. Considering Joint Fuel Research

NEW YORK, March 15—Members of the National Automobile Chamber of Commerce have been informed that the directors are considering a joint fuel research plan by the N. A. C. C., the American Petroleum Institute, the Society of Automotive Engineers and the United States Government.

Based on the report that it is possible to produce a great deal more gasoline under certain processes than is now being done, the directors have authorized the appointment of a committee to examine what is known as the "Greenstreet Process" as it is in operation in some of the refining plants.

OHIO BODY REPORTS LOSS

BOSTON, March 15—The Ohio Body & Blower Co. reports a net loss for 1921 after charges and inventory adjustment of \$558,660, as compared with a net loss of \$397,338 in the previous year.

Net sales in 1921 were \$1,531,468, as against \$2,737,260 in 1920. The cost of sales, inventory adjustment, etc., reached a total of \$1,601,397 in 1921, as compared with \$2,479,540 in the year previous. The total operating loss was \$391,568 in 1921 and \$229,908 in the year before.

Scandinavia Calls for Parts Stations

American Exporters Must Establish Them to Offset Domestic Competition

WASHINGTON, Mar. 13—Study of the Scandinavian motor car industry by Commercial Attache N. L. Anderson indicates that American exporters must place a complete line of spare parts at a central distribution point in Scandinavia in order to offset domestic competition. He has reported to the Department of Commerce that there is a good field for automobile sales, provided the difficulties incident to obtaining spare parts are overcome. It is suggested that main service stations be located at Copenhagen, as it is a principal commercial center station of Scandinavian and Baltic countries.

Replacement, Great Problem

Anderson states that it is of utmost importance to the success of American business that some plan be devised to eliminate the replacement problems from which dealers are suffering, due to the distance from American factories.

The motor market in Scandinavia is still unstable. Financial conditions put the "Scania Vabis," the largest motor car manufacturers, out of business for several months. A reorganization is now being effected in Sweden under the name of Aktiebolaget "Vardsholmen." The factory in Denmark continues under the old name and has kept up the manufacture of gears.

Accordingly, it may be said that "Scania Vabis" is to-day out of business as an automobile manufacturing concern, but the high quality and former success of the "Scania Vabis" cars will probably bring about a further reorganization of the company for the renewed manufacture of automobiles when times are more normal.

Other Car Makers

De Forenede Automobilfabrikker (United Automobile Factories), with headquarters at Odense, Denmark, and a branch factory at Copenhagen, was started about five years ago by uniting three existing Danish automobile factories—the Thomas B. Thrige at Odense and the Anglo Dane and Jan in Copenhagen. This concern has a capital of 2,000,000 Kroners, employs about 200 workmen, and produces 200 cars annually under the trade name "Triangle." This output is almost entirely trucks, which are very substantial and economical in upkeep. Motor locomotives are also manufactured by this concern. The financial rating of the company is very good, in spite of the general bad condition of the local automobile market.

In addition, Kramper and Jørgensen (the "Gideon" motor cars) of Horsens, Denmark, and A/B Tidarholms Fabrikker of Sweden, have until recently been manufacturing automobiles in Scandinavia. Both these firms, however, are now out of motor car manufacturing.

Owner's Confidence Is Big Trade Item

**E. K. McGinnis, Formerly With
Packard, Says Service Is
Important Factor**

AUSTIN, TEX., March 11—"The automobile distributor must look at his business in the light of confidential relationship with his customers, as the doctor or lawyer with his clients; if he abuses the confidence he will lose future business."

This was the expressed opinion of Edward Karl McGinnis, formerly connected with the sales department of the Packard Motor Car Co. of Kansas City and now Professor of Business Administration in the University of Texas. McGinnis believes that there are three chief faults in the sales policies of automobile distributors.

He said:

"The greatest mistake, I believe, is in the service situation. When the demand for automobiles fell off in 1920 very decidedly, those companies that had been 'gouging' in their service policy were the first to find business leaving them. Many were forced to liquidation or bankruptcy on account of enemies made by their service policy."

McGinnis then explained the service policy by an example. In St. Louis a truck company, which later went bankrupt, left a monkey wrench in the rear axle of a truck. The wrench tore out about \$1,000 worth of repairing for the purchaser. He brought the truck back to the manufacturer for repairing, and they charged him for the work, even though the break-down was due to their own carelessness.

As an exception to this questionable policy, McGinnis cited the case of the Ford factory. Ford, he explained, has a school at the factory for service men; the most experienced workmen in each distributing house would send in candidates for the school. Ford paid them regular wages while in the school, and gave them stiff examinations regularly on all work. Then they were sent back to their jobs. A uniform charge for all repair operations has been set.

Another mistake made, McGinnis said, is the trade-in policy. He then stated:

A third mistake is in the sale of cars on credit. They are sold on a basis of 15 to 20 per cent interest on deferred payments. But the interest charge is so mixed with the cost of insurance, and is a flat rate on the whole price of the car, that customers are deceived in many cases in the amount they thought they were paying.

NEW YORK PASSES FEE BILL

ALBANY, March 16—Increased registration fees for motor vehicles are authorized under two bills passed by the Assembly and sent to the Governor. One provides that the fee for passenger cars shall be 50 cents for each 100 pounds of the cars, fully equipped, weigh 3500 pounds or less, and 75 cents for each 100 pounds if they weigh more than 3500 pounds. The fee for all other cars would

MILWAUKEE MAY HAVE "TRACKLESS TROLLEY"

MILWAUKEE, March 13.—As the result of the success experienced by the Milwaukee Electric Railway & Light Co. in the operation of a number of motor buses as connecting lines to regular street car traffic arteries and similar uses the utility has now applied to the Milwaukee common council for permission by ordinance to place in operation a "trackless trolley" on Lincoln Avenue, which would be the first motor bus line using overhead trolleys for power in operation in Milwaukee.

by \$8. Motor trucks of two tons or less would be assessed \$16, and the registration fees of all other trucks would be \$8 for each additional ton.

Industry in Canada Shows Big Expansion

OTTAWA, ONT., March 14—The rapid expansion of the automobile industry in Canada is shown in a report issued by the Dominion bureau of statistics. The total value of production in 1920 was \$137,420,351, an increase over the total figures for the previous year of \$36,223,645. The value of the automobile output in 1920 was over \$101,000,000; of motor supplies and accessories, over \$19,000,000, and automobile repairs, over \$16,000,000.

The capital invested in the automobile manufacturing industry in the Dominion in 1920 was nearly \$54,000,000, an increase of about \$19,000,000 over the capital invested in the previous year. Registration of motor vehicles in use in Canada increased from 69,598 in 1914 to 469,310 in 1921.

GORDON LEE IN CHICAGO

CHICAGO, March 15—Gordon Lee stopped here to-day on his western trip to talk to the Automotive Equipment Association on export possibilities. Lee's story of the new work being done by the Department of Commerce was largely new to these manufacturers. Especially were they surprised at the movement to describe the channels of trade in foreign countries and for aiding manufacturers to produce the kind of goods that could be marketed in these countries. There was also present at the meeting Paul L. Palmerton, chief of the Rubber Division.

TRAINLOAD OF WHITES

SAN FRANCISCO, March 15—More than 100 White motor trucks have arrived here on a fast freight train consisting of 45 cars consigned to mercantile firms, utilities or municipalities in various parts of the coast territory. In the trainload were trucks of four capacities, $\frac{1}{2}$, 2, $3\frac{1}{2}$ and 5 tons.

Japan Is Preparing to Start Road Work

**Leaders Confer with Samuel Hill
—Country Convinced of
Highway Needs**

LOS ANGELES, March 13—It is expected that Japan this year will enter upon the comprehensive national road and highway building campaign which has been planned for several years. Samuel Hill, president of the Columbia River Highway Association and the leading spirit of the Pacific Highway Association, is now in Japan conferring with the Japanese leaders in the movement to establish a network of highways throughout the empire.

The carrying out of the program outlined holds great possibilities for the American manufacturers of automobiles, for just as soon as Japan, China and the other countries of the Far East are "sold" on the value of good roads as the United States has been "sold," the Orient will become a market of tremendous fertility for motor vehicles. Hill says:

Japan has now reached the place where she is convinced of the need of good roads and rapid transportation. All nations preparatory to launching upon an extensive road building program must go through a period of education. Japan has gone through that, the same as America went through it and as many other nations have done.

In Japan all that remains to be done now is to organize the forces for carrying out such a program, to lay out a thoroughly scientific and proven method of construction, including the correlation of all the roads of the Empire, and then begin the actual work of construction. I am convinced this work will be undertaken later this year.

Use of Rail Declines in Transporting Stock

KANSAS CITY, March 13—The Monthly Review of the Federal Reserve Bank of Kansas City takes official cognizance of the radical increase in the use of motor trucks during the past few months for transporting livestock to the six principal markets in this District.

It is well known that the open winter has been propitious for the highway transportation of commodities, but no comment had previously been made on the actual extent of this practice, especially in its reference to railroad traffic. The Federal Reserve Bank, however, collating data on movements of stock, notes the decline in the number of railroad cars carrying stock to market.

The editor, however, did not rest content with that particular piece of information, but sought other data to round out livestock figures. The marked increase in numbers of animals received at yards "through the gates," that did not come by railroad, gave the cue—the "drive-ins," including both stock actually driven in on foot and that transported in vehicles, showing a marked increase.

MEN OF THE INDUSTRY

N. H. Van Sicklen, at one time publisher of Motor Age and latterly manufacturer of the Van Sicklen speedometer, has been appointed assistant general manager of Apperson Bros. Automobile Co. Van Sicklen is a pioneer in the industry, having been long identified with several of its branches. He is also well known nationally as a sportsman. T. E. Jarrard will continue as vice-president and sales manager.

Wilbur F. Opdyke, for a number of years connected with the Crescent Tool Co., Jamestown, N. Y. and later connected with the Walden Worcester Co. of Worcester, Mass., has been appointed district sales manager for the Ohio and Michigan territory for C. N. & F. W. Jonas, direct manufacturers' representatives to the jobbing automotive trade of a number of well known accessory lines.

F. W. Fenn, secretary of the motor truck committee of the National Automobile Chamber of Commerce, will address the engineering students of the Massachusetts Institute of Technology on March 24. He will speak before the Bay State Automobile Association on March 22, and will discuss the use of motor buses by traction lines before the New England Railway Club on March 23.

W. T. Helfer who has been ill for more than a year has fully recovered his health and is contemplating moving from Detroit where he is now living to Southern California, probably Los Angeles, to return to active work in the industry. Helfer is one of the veteran tire men of the country, being the first branch manager of the Diamond Rubber Co. in Boston.

Francis W. Davis, one of the best known men in the automotive engineering field, has resigned as consulting engineer of the truck department of the Pierce-Arrow Motor Car Co. with which he has been associated for several years. Other than leaving on an extended trip to Europe he has announced no definite plans for the future.

Frank J. Pardee, for many years identified with the automobile industry in Chicago and for a long period sales manager of the Diamond-T Motor Truck Co., has been named general sales manager of the Leach Motor Car Co. of Los Angeles, succeeding Roy D. Hertz who has retired from business.

C. W. Henry has joined the field force of the Elgin Motor Car Corp. as district manager in charge of the Minneapolis zone. He was formerly associated with Dodge Brothers and with the Maxwell-Chalmers organization in the capacity of district representative.

George C. Kloss, formerly eastern district sales manager of the Gillette Rubber Co., has been appointed special representative of the Dallon Tire & Rubber Co. of Baltimore. Kloss has served with various tire companies since he first joined the industry in 1900.

W. H. Sackman who recently resigned as chief engineer of the Light Manufacturing & Foundry Co. of Pottstown, Pa., has been chosen a director and chief engineer of the Pennsylvania Gasoline Drill Co. of Philadelphia.

Earle T. Sutton, formerly advertising manager of the Denby Motor Truck Co. and having wide sales experience both wholesale and retail, has been appointed to the factory staff of the Signal Truck Corp., Detroit.

H. K. Wheelock has returned as managing head of the Western Vulcanizer Manufacturing Co., Chicago. Wheelock relinquished

management a year ago on account of ill health and his duties were taken over temporarily by W. J. Jarratt.

E. Z. Jones, formerly director of sales of the Winther Motor Corp. and handling sales in 1921 for the Jackson Motors Corp., has been appointed New York branch manager for the Anderson Motor Co.

P. L. Palmerton, chief of the rubber division of the Bureau of Foreign and Domestic Commerce, will leave soon for Europe to make the first governmental survey of markets abroad for tires and other rubber products.

William C. Hunt, formerly advertising manager of the Columbia Motors Co., has become automobile editor of the Detroit Journal.

Guy Core, former sales manager of the Jackson Motor Shaft Co., has become assistant sales manager of the Reynolds Spring Co., Jackson, Mich.

Alfred Reeves, general manager of the National Automobile Chamber of Commerce, will leave Monday for a two weeks' trip to the factories of members of the organization.

J. Henry Smith has been appointed manager of sales of the automobile body department of the Pullman Co. with headquarters at Chicago.

F. B. Willis has been named sales manager of the H. C. S. Co., Indianapolis.

Wright Rubber Products Formed; Will Make Mats

RACINE, WIS., March 18 — The Wright Rubber Products Co., a new Racine, Wis., corporation with \$300,000 capital, will start work immediately on the erection and equipment of a factory. It will make a wide variety of mechanical rubber goods, including mats for motor cars and running boards.

It will not, at least for the present, engage in tire and tube manufacturing. Clarence Wright, for many years connected with Racine tire and rubber companies, is president.

Senate Committee Favors Further Federal Road Aid

WASHINGTON, March 13—Continuance of Federal aid to states in highway construction is advocated in the report of the Senate Committee on Postoffices and Post Roads in the postoffice appropriation bill reported to the Senate. The committee recommends an appropriation of \$50,000,000 for Federal aid during the fiscal year of 1923, and suggests the authorization of \$65,000,000 in 1924 and \$75,000,000 in 1925.

The committee declares that refusal to appropriate for 1923 means the abandonment of Federal aid. It also advocates an appropriation of \$2,200,000 for air mail service from New York to San Francisco. The current appropriation amounts to \$4,125,000.

FORD TITLE TO LINCOLN CLEAR

DETROIT, March 15—Federal Judge Tuttle has decided that Henry Ford has a clear title to the properties of the Lincoln Motor Co. and that any claims filed by the government must be settled by the Detroit Trust Co. as receiver for the old Lincoln company.

Boston Holds Last Big Sectional Show

Exhibit Clinches Impression From Other Parts of Country of Public Interest

BOSTON, March 15—Boston's twentieth annual show, the last of the industry's great sectional exhibitions this year, is clinching more firmly the impressions made by the ten weeks of shows preceding it that popular interest in motor cars is strong and that, aside from conditions peculiar to certain parts of the country, a sales volume in excess of 1921 may be expected during the remainder of the spring selling season.

Attendance has been satisfactory and has been increasing daily, the interest indicating a good proportion of potential buyers. New England dealers up to Wednesday night had registered close to 50 per cent of their numbers at the show, and most of the sales meetings conducted by the manufacturers and distributors have been well attended.

Sales Resistance Diminishing

Motor car dealers from the outlying communities brought encouraging reports of diminishing sales resistance due to price uncertainty and a more hopeful public attitude concerning general business conditions.

The trade in Boston proper and the adjacent territory is spotty. Dealers who have close, efficiently operating organizations are moving cars in fairly good volume right now. Some of them are piling up large spring delivery sales. The rest are showing some improvement over the sales of a year ago.

There is a note of increasing optimism in the truck section, due to the better general business tone of the territory, and all of the exhibitors expect the spring months to show a marked improvement in sales. In fact, selling already has reached good proportions in lighter trucks and business cars.

Few Motor Vehicles Made in Germany Reach America

WASHINGTON, March 15—Only 2.2 per cent of the 968 motor vehicles exported from Germany were received in this country during January, according to an analysis of foreign trade by the Automotive Division of the Department of Commerce. Holland was the principal country of destination, as 21.5 per cent of the German exports were taken across the frontier.

Exports from Germany showed a slight decrease as compared with December. Belgium accepted 17 per cent of the passenger cars, trucks and chassis (for both); Sweden, 9 per cent; Spain, 9 per cent; Denmark, 8 per cent; South East Asia, 6.6 per cent; South America, 2.7 per cent; Switzerland, 1.6 per cent; Austria, 1.5 per cent, and all other countries less than one per cent each.

FINANCIAL NOTES

Gray & Davis, Inc., for the calendar year of 1921, which was the first full year operated under American Bosch Magneto management, reports an operating loss of \$179,594, compared with a deficit in 1920 of \$468,108 and with a net profit in 1919 of \$465,680. The Cambridge plant, with sales of \$1,061,642, showed an operating profit of \$6,980, and the Amesbury plant, with sales of \$791,193, reported an operating loss of \$186,574. In 1920 the net loss for the first seven months under the old management was \$436,109, and in the final five months under the new management it was but \$4,998, of which the Amesbury plant showed a loss of \$53,215, and the Cambridge plant a profit of \$48,216.

Maxwell Motor Corp. executive committee has voted to anticipate the maturity of the issue of approximately \$3,850,000 series A gold notes due June 1, 1922, by retiring them under the call of privilege of April 1. The strength of the company's cash position is indicated by this action in retiring the notes sixty days before maturity. Maxwell carries no bank loans at the present time.

Reynolds Spring Co. of Jackson has declared a dividend of 1% per cent on the preferred A stock, payable March 31, 1922 to stockholders of record at the close of business on March 22.

Hupp Motor Car Corp. has declared its regular quarterly dividend of 1% per cent on preferred stock, payable April 1 to stock of record March 20.

Fisher Body Corp. of Ohio has declared its regular quarterly dividend of \$2 on the preferred stock, payable April 1 to stock of record March 25.

Kelsey Wheel Co. has declared the regular quarterly dividend of \$1.50 on the common stock, payable April 1 to stock of record March 20.

Meixell States Gasoline Tax Is Discriminatory

NEW YORK, March 15—Motor vehicle taxes upon gross tonnage and horsepower instead of upon gasoline purchases were advocated by Harry Meixell, secretary of the Motor Vehicle Conference Committee, in an address before the Oil Trades Association of New York. He said:

The main objections to the gasoline tax are that it discriminates against the internal combustion vehicle in favor of those driven by electricity or steam; that it fails to discriminate between the use of automobiles for pleasure and for business; that it is costly in administration and brings with it other and higher taxes upon the users of motor vehicles.

Without question, Meixell said, owners of motor cars should pay a share of the expense of maintaining highways, but only on the basis of gross weight and horsepower. He estimated that one-tenth of the motor vehicles in use in the United States are commercial trucks.

BOWSER TIME LENGTHENS

FORT WAYNE, I.D., March 14—Scheduled hours for employees in the shop of S. F. Bowser & Co., Inc., of this city, pump and tank manufacturer, are now fifty a week, due to increased business. The day men will work nine hours

a day for the first five days of the week and five hours on Saturday. The night men will work ten hours a night for five days a week, starting at 7:30 o'clock. Overtime will not start until the scheduled hours for the day have been worked. This is the longest work schedule in force at the Bowser plant for some time.

60,000, G. M. Output in First Three Months

NEW YORK, March 15—Production by the various General Motors divisions, including all types of motor vehicles, will approximate 60,000 for the first three months of this year, as compared with about 25,500 for the same period in 1921. The total output of all divisions for January were approximately 15,400, compared with 6000 in January, 1921.

February production increased to 21,000 as compared with 8900 for February last year. Buick continues to lead all other divisions. Business of the General Motors Truck Co. has not increased to the same extent and sales by the Samson tractor division have been small thus far this year.

Kelsey Wheel Co. Reports \$16.06 Earned on Common

DETROIT, March 16—Although the gross sales of the Kelsey Wheel Co., Inc., showed a substantial decline during 1921, at \$17,487,597, compared with \$25,200,913, during 1920, the net profits are shown in the annual report, after charges and Federal taxes amounted to \$1,792,862 equivalent, after providing for preferred dividends, to \$16.06 a share earned on the \$10,000,000 common stock.

Net profits during 1920 totaled \$1,916,008, or at the rate of \$17.24 a share. After payment of deferred dividends, there was a surplus of \$1,606,109, as compared with \$1,724,107 at the end of 1920.

MULLINS BODY CORP.

SALEM, OHIO, March 16—The Mullins Body Corp. for the year ended Dec. 31, 1921, reports net operating loss of \$87,617 after expenses. Net sales during the year amounted to \$1,431,243. Gross profits from sales after deducting cost amounted to \$130,061. After deducting miscellaneous charges of \$23,327 and expenses \$217,678, there was a deficit of \$110,392.

AVERY REPORTS DEFICIT

PEORIA, ILL., March 15—Avery Co.'s annual report shows a net deficit of \$714,969 on operations and a total deficit of \$2,657,827, after inventory adjustment and other expenses, compared to an operating profit of \$17,355 in 1920.

The comparative balance sheet as of Nov. 30, 1921, shows accounts receivable, etc., of \$1,243,713, against \$817,625 in 1920; and inventory of \$4,209,696 in 1921, compared to \$7,010,994 in the previous year.

BANK CREDITS

Written exclusively for AUTOMOTIVE INDUSTRIES by the Guaranty Trust Co., second largest bank in America.

The trend of the call money market was generally downward throughout last week. The week's range was 3½ per cent to 5 per cent, as compared with 4 per cent to 5½ per cent in the previous week. For fixed date funds offerings were in better supply, although the range remained unchanged at 4% per cent to 5 per cent for all maturities from sixty days to six months. The prime commercial rate continued to be quoted at 4% per cent to 5 per cent. The plentiful supply of funds during the greater part of last week was principally due to the accumulation of money here for the March 15 turnover, which will include the payment of the first installment of the 1921 Federal Income Tax.

Further gains of \$14,500,000 of gold and of \$13,200,000 of total cash reserves were shown in the Federal Reserve statement as of March 8, 1922. Total bills on hand decreased \$70,309,000 and total earning assets \$39,506,000. Total deposits decreased \$38,391,000. Federal Reserve notes in circulation, on the other hand, increased \$451,000.

The gold reserves of the New York institution increased last week \$3,137,000. There was a shrinkage of \$9,873,000 in total deposits. Federal Reserve notes in circulation showed an increase of \$1,607,000, and the ratio of total reserves to deposit and Federal Reserve note liabilities combined increased from 84.1 per cent to 84.9 per cent.

Bradstreet's Index Number of commodity prices as of March 1 showed a further slight gain, the eighth gain shown in nine months in the general price level since early last June. The index numbers as of March 1 indicates a gain of 1.5 per cent over that of February 1 and of 8.5 per cent over that of June 1, 1921, but it is 2.2 per cent below the level of March 1, last year.

Proponents of Metric System Are Organizing

WASHINGTON, March 14—That proponents of the metric system are going to stimulate efforts looking to the establishment of this plan of measurement has become evident. An organization of the local section of workers for the installation of the metric system and the passage of the Britten-Ladd bill was effected last Friday night at George Washington University Law School.

It is also proposed to name an "educational" committee in order to acquaint the people of the country with the alleged benefits that would arise from the metric system. Senator C. F. Ladd, of North Carolina, spoke of an amendment to his bill which would provide that in 1926 all Government specifications and engineering works be done with the use of the metric system.

INDUSTRIAL NOTES

Deman-Myers Cord Tire Co. reported a bright outlook for the year at its annual meeting. The overhead expense has been reduced to the minimum, it was stated, and the company is now operating on the lowest cost possible and still maintain the efficiency of the organization. Full capacity production is planned, although conservatism will mark the company's program. F. F. Dugan, formerly with the Goodyear Tire & Rubber Co., has been elected vice-president and director of sales. C. L. Mason, sales manager, will be in charge of distributors and branches. Additions to the field force include J. H. Appleby who will cover Illinois and J. P. Egan whose territory takes in Ohio. The Board of directors elected the following officers: President, Walter E. Myers; vice-president, F. F. Dugan; secretary and general manager, Walter R. Demman; treasurer, John E. Morris; and assistant secretary and treasurer, L. M. Harper. The offices of the company have been moved from Cleveland to Warren, Ohio.

Ewing Bolt & Screw Co., Detroit, has acquired the plant of the Detroit Machine Co., new capital being provided for the development of both concerns. Plans contemplate the sale of the Machine company's property and the construction of a new plant in the River Rouge near the Ford steel plant on a site owned by the Ewing Corp. Myles E. Ewing, president and J. A. Hale, secretary and treasurer of the Ewing company, assume the same offices with the Machine company. David W. Pell, manager of the Machine company becomes production manager of the Ewing concern. The directors are Hal H. Smith, Frank W. Blair, Arthur T. Waterfall, David W. Pell, A. N. Marlon, Myles E. Ewing, J. A. Hale, all of Detroit; and H. J. Douglas and David L. Rockwell both of Cleveland, the latter being vice-president.

Perfection Heater & Manufacturing Co., Cleveland, at its annual meeting elected C. S. Pelton president and general manager. W. A. C. Smith vice-president and F. D. Kellogg secretary and treasurer. E. L. Jones was appointed sales manager and G. W. Rouvel, assistant treasurer. All directors were re-elected. The company reports business to be in a very satisfactory condition with bright prospects for 1922. A number of important changes are being made in its production equipment.

Kendell Engineering Corp., Fort Wayne, Ind., formerly the Kendell Engineering Co., has completed its plans for expansion under which it will begin operations immediately on a new plant. There has been no changes in personnel, C. A. Kendell continuing to act as president and engineer; Robert L. Kendell as vice-president and sales director and M. W. Cartwright as secretary and treasurer.

Carpenter Tire & Rubber Co., Hempstead, Long Island, is confining its business exclusively to the manufacture of solid motor truck tires. Production is now fully underway at its new plant. The company was formed several years ago as distributors, with Harry B. Carpenter as president and general manager. Associated with him is Harry Davenport as general superintendent.

Torbansen Axle Co. is establishing a chain of parts service stations, each station to be centrally located and to carry a complete line of the company's parts. It is planned to arrange these locations so that there will not be more than twenty-four hours delay in

service. It is expected that the entire distributing organization will be completed within the next sixty days.

Lakeside Forge Co., Erie, Pa., has opened offices in the Penobscot building, Detroit, and at 334 North Capitol Avenue, Indianapolis, in addition to its present district sales offices in New York and Cleveland. These are industrial sales offices and are not in any way connected with the jobbing or dealer end of the business.

Tuscara Rubber Co., a \$1,500,000 company making special rubber articles at Dover, Ohio, has been placed in the hands of C. C. Adams and Henry Krantz as receivers. The corporation was organized in 1919 and started operations in 1921. There are approximately 1,600 stockholders throughout Ohio and West Virginia.

Chicago Automobile Supply House announces a change in its personnel. William M. Weber is president and treasurer; Robert S. Mitten, vice-president and general sales manager and Otto H. Weber, secretary. The former secretary and treasurer, J. E. Brennan, has retired.

Kelly-Springfield Tire Co. at its annual meeting increased the number of directors from eight to twelve, the new members being C. A. Brown, T. C. Marshall, J. V. Mowe and M. Switzer. The old directors were re-elected.

New England Velle Co., Boston, is developing plans under which it will finance both wholesale and retail car sales.

E. Edelmann & Co. plant in Chicago has been sold to the Bassick Manufacturing Co. for \$260,000.

Cleveland Fisher Body
Plant Operating Full Time

CLEVELAND, March 14.—In line with the general improvement in automotive conditions here the Fisher Body Corp. plant is now operating on a full time basis and is turning out 200 bodies a day. Practically capacity production is the schedule, with 2,800 men employed. About six months ago the plant was practically closed down, after having been in production with about 3,000 men the latter part of 1920. Last October production was resumed on a small scale and it has been increased steadily.

At the plant it was reported that inquiries for bodies of the closed type have greatly increased.

The Baker R & L Co. has announced that business has reached 50 or 60 per cent of normal. The Ohio Body Blower Co. and the Rubay plants also report that inquiries have increased and that production gained during March.

The industry is responsible largely for the expansion of the Otis Steel Co. and the Empire Rolling Mill Co., both of which are going into the production of steel sheets.

REO ACTIVITIES INCREASE

DETROIT, March 13.—Reo Motor Co. has placed its engine department on approximately full time production, and will increase its operations in other departments as the supply of engines is increased. Steady growth in orders is reported from all parts of the country. The new Reo special taxicab will be ready for the market within thirty days.

METAL MARKETS

Significant in the present condition of the steel market is the reaction which the announcement that certain producers of bars, shapes, and plates had revised upward their asking prices for these products had upon the mind of the industry as a whole. Not a few sales managers were frankly uneasy that the advance which was made about these advances might be misconstrued and tend to scare out of the market buyers of steel products prices on which never descended to the low levels of bars, shapes, and plates. At 1.35¢, the level recently prevailing in the bar market, this product was \$1 a ton below its ten-year pre-war average.

Plates and shapes were \$3 a ton below that average, whereas black sheets at 3¢, the price in vogue throughout this year, are selling at \$14 a ton above their ten-year pre-war average. While there was ample statistical ground for the advance in bars, shapes, and plates, the independent that led in the upward revision announced the higher quotation only after his books were comfortably filled with orders at the old price. Noteworthy it is also that at about the same time this interest raised its price on structural shapes \$3 a ton, another independent booked a large structural contract, erected, on a basis of 1¢ a pound for structural shapes or \$10 a ton below the new quotation of the former and \$7 a ton below the market that had prevailed previously.

That the independent who led in the advance on bars, shapes and plates had followers, means very little. In the first place, compared with other steel products, those affected sold at too low a price. Moreover, any fairly prominent steel producer who announces an advance will always have a certain number of followers. The latter will try it out for a time. If they can not book orders at the new price, the responsibility for the advance rests with its originator, and they can very easily back water after a certain length of time. As concerns distinctly automotive steel products, especially sheets, producers generally are in a "let well alone" frame of mind.

Pig Iron.—Several sizeable tonnages for second quarter delivery have been contracted for by automotive castings makers in the Middle West, malleable seemingly leading foundry in point of consuming interest. The market's tone is fairly steady.

Steel.—Quite a few transactions in steel bars have been consummated of late for account of automotive consumers at prices below those announced by some of the independents. The automotive industry has the market for cold-finished steel bars virtually to itself. Similar conditions prevail in the hot-rolled and cold-rolled strip steel industry which is now operating at the highest rate of the year, about 50 per cent of capacity. The sheet bar situation is unchanged, \$29 being generally quoted, Pittsburgh or Youngstown. Demand for all sorts of sheets continues steady, as do prices. No unusually large commitments are noted but automotive consumers are buying consistently and nearly always for early shipment. Improvement is also noted in the demand for bolts and nuts. Orders for several thousand tons of frame stock and full finished sheets are overhanging the market.

Aluminum.—If there are any bargain lots of sheets around, they are visible to buyers. Ingots, of course, continue in abundant supply, but holders are somewhat more reserved when it comes to prices.

Copper.—The market is gradually recovering.

Calendar

SHOWS

April 1-16—New York, Second Annual Electric Automobile Show, Showroom of the New York Edison Co.

FOREIGN SHOWS

March, 1922—Santiago, Chili, Annual Automobile Show.
March 10-July 31—Tokio, Japan, Peace Exhibition.

April 16-23—Mexico City, Annual Automobile Show, Auspices of the Automotive Division of the American Chamber of Commerce.

April 22-May 1—Prague, Czechoslovakia, Fourteenth International Automobile Exhibition.

May—Shanghai, Exhibition of Road Building Material.

May, 1922—Quito, Ecuador, Agricultural Exposition, celebrating Centenary of Ecuador. Automotive Section.

May 1-15—The Hague, Automobile Show, also Airplanes and Motorboats. Secretary, Spui 185, The Hague.

May 6-21—Scheveningen, Automobile Show.

May 24-June 5—Barcelona, Spain, Automobile Show under Dealers' Direction.

May, 23-June 5—Prague, Motor Show, Hotel de Ville.

July 1-24—London (Olympia), Aircraft Exhibition.

Sept. 1922—Rio de Janeiro, Brazil, Automobile exhibits in connection with the Brazilian Centenary Association Automobilista Brasileira.

Sept. 15-20—The Hague, Automobile Show.

September—Buenos Aires, Argentina, Annual Exhibition, Sociedad Rural Argentina.

Oct. 12-23—London (Olympia), International Commercial Vehicle Exhibition.

November—London (Olympia), Automobile Show.

Nov. 10-Dec. 19—Brussels, Automobile Show, Palais de la Cinquantenaire.

Nov. 29-Dec. 4—London (Olympia), Cycle and Motorcycle Show, British Cycle Motors, The Tower, Warwick Road, Coventry.

November—Buenos Aires, Argentina, Annual Exhibition, Automovil Club Argentino.

CONVENTIONS

April 20-22—Buffalo, N. Y., Sixth Annual Convention of the American Gear Manufacturers Association.

May 8-10—New York, National Association of Manufacturers.

May 10-12—Philadelphia, Ninth National Foreign Trade Convention of the National Foreign Trade Council.

May 16-18—Washington, D. C., Annual Meeting of the Chamber of Commerce of the United States.

June 11-15—Milwaukee, Annual International Convention of the Associated Advertising Clubs of the World.

June 26-July 1—Atlantic City, Twenty-fifth Annual Meeting of the American Society for Testing Materials, Chalfonte-Haddon Hall Hotel.

August 28-Sept. 2—Detroit, National Safety Congress.

Sept. 18-23, 1922—Rome, Italy, Second Annual Meeting of the International Chamber of Commerce.

S. A. E. MEETINGS

Detroit, Mar. 24, April 23, May 26.

June 20-24—White Sulphur Springs, W. Va., 1922 Summer meeting of Society of Automotive Engineers.

Sacramento Market Is Becoming Active

Reflects Opinion of Farmers and Business Men That Good Year Is Here

SACRAMENTO, CAL., March 9—After passing through one of the worst winter seasons ever known here in the automobile industry, indications are there are much better times ahead. Conditions here have been as elsewhere. Financial readjustments and depression, price uncertainties and a general drop in the price of farm products, with no corresponding decrease in freight rates or production costs, have made the farming districts poor fields for the motor car salesman.

Of course, the winter season always is light and spring always shows a decided improvement. But the winter just ended was worse than usual, far worse. There were almost no sales. But the spring is brighter than ever, and sales already are coming along in good shape. With the conviction that prices have been settled for the time being, buyers seem willing to open up the purse strings and the first few bright, warm days of the season saw hundreds of new jobs on the highways of northern California.

The automobile market may be taken as a fair index of conditions generally. Automobiles are bought when there is money available or in sight. Hence the fact that the market is showing activity reflects the belief of the farmers and business men that this is going to be a good year. This winter has been ideal for fruit; there should be big crops which means many automobiles.

S. A. E. APPROVES CHANGES

NEW YORK, March 15—The revisions in the standard body nomenclature, to-

gether with other recommendations of the Standards Committee made at the winter meeting of the Society of Automotive Engineers, have been adopted by a mail vote of the society. This excludes, of course, the recommendations pertaining to the stamping of engine numbers which were withdrawn by authority of the council and the revision of the engine testing forms, which was referred back to the Engine division.

Britain May Eliminate Automobile Import Tax

LONDON, Feb. 24 (by mail)—The Industries Act passed by the Coalition Government has proved so irksome and expensive to certain British export industries of national importance that it is almost certain to lapse. The dropping of this legislation no doubt is responsible for the rumor that Britain will revert wholly to her free imports policy.

The attempt to keep out automobiles by a 33 per cent duty was frustrated early in its history by the expedient of assembling in Canada and shipping here under the preferential rate, which generally means a drop from 33 per cent to 9 or 10 per cent duty, at which rate the tariff is economically useless and wasteful to collect. Moreover the setting up of assembling works in Britain by American interests and possibly in the near future by at least one French firm will leave the British automobile makers bereft of any bolstering up anticipated from the tariff.

7200 WILLS ORDERED

DETROIT, March 14—The Wills Sainte Claire Co. has issued a statement that it has contracts with distributors for 7200 cars for 1922 delivery. February production of 15 daily has been increased to 20 daily for March. Six hundred men are now employed at the Marysville plant.

New Orleans Orders Eight Kelly Trucks

Plant Force Grows—International Harvester and Westcott Motors See Brighter Outlook

SPRINGFIELD, OHIO, March 14—Good sized orders are being booked by The Kelly-Springfield Motor Truck Co. During the past week it received an order for eight motor trucks from the city of New Orleans, to be delivered within the next two weeks. There are 75 per cent more men employed in the plant to-day than there were last October. A number of men were added to the force during the past week.

While in the city conferring with Superintendent Charles H. Smart, of the Springfield Works of the International Harvester Co., A. A. Jones, assistant to Cyrus McCormick, works manager, with headquarters at Chicago, said that the outlook is brightening considerably. Smart stated that a shipment of high speed trucks was made during the past week to Australia. The foreign demand for trucks is increasing, he said. The Springfield works is turning out 50 trucks daily. These are being shipped about as fast as they are produced.

Orders have been steadily increasing at the plant of The Westcott Motor Car Co. It was stated by one of the officers of the company that more orders have been received during the past week than for any one week during the past two years. On March 15 the company will increase its production to meet the demands of the trade.

Material has been received preparatory to speeding up production. Indications are that the plant will be busy for the next three months at least. The company is receiving orders from the New England states, north of Virginia, and as far west as Chicago.

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Keen Sales Competition in Middle Priced Car Field

46 per cent of all car manufacturers are competing for the 18 per cent of total car business comprised in the middle priced market. This article analyzes the \$1000-\$2000 car market, and presents statistics and methods of value to passenger car manufacturers.

By Norman G. Shidle

Charts and Statistics by Raymond B. Prescott

THE market for cars selling between \$1,000 and \$2,000 calls for special analysis, since it presents the field of keenest competition in the automotive industry. Manufacturers building cars in this middle-price group need, perhaps more than any others, detailed data upon which to plan production and sales effort.

In 1921 there were 85 N. A. C. C. members producing passenger cars, and of this total 33 were making cars in the middle-price group; 1921 passenger car production totaled 1,457,000. Of this total 291,432 consisted of middle-price class production. In other words, 39 per cent of the car manufacturers were competing for 20 per cent of the business.

The 1922 production figures, as predicted by AUTOMOTIVE INDUSTRIES, indicate that about 306,000 cars, or 18 per cent of the total 1922 production, will consist of cars in the \$1,000-\$2,000 class. But a survey of the N. A. C. C. membership lists shows that 46 per cent of the total car manufacturers in the field this year are competing for this 18 per cent of the probable total business.

The chart in Fig. 1 shows the relation of production

in the middle-price group to total car production for the years 1912 to 1921 inclusive, the figures for 1922 being predicted. A study of these curves indicates that the proportion of cars in this group as related to total car production has not varied widely from year to year, although the "high spending" years of 1919 and 1920 reacted to the benefit of the middle-price group at the expense of the "under \$1,000 group." These years were clearly abnormal, however, both for the automotive industry as a whole and for the middle-price group.

The manufacturer in this price group is interested in two sets of data:

1. The status and probable development of the price group as a whole.
2. The relation of his individual company to the group development.

Viewing the figures for this group over the period indicated, a tendency toward a relative decrease appears. That is, the percentage of cars in this group, as compared with the total car production, shows no indication of growing any larger, the tendency being rather in the opposite direction. This relation, of

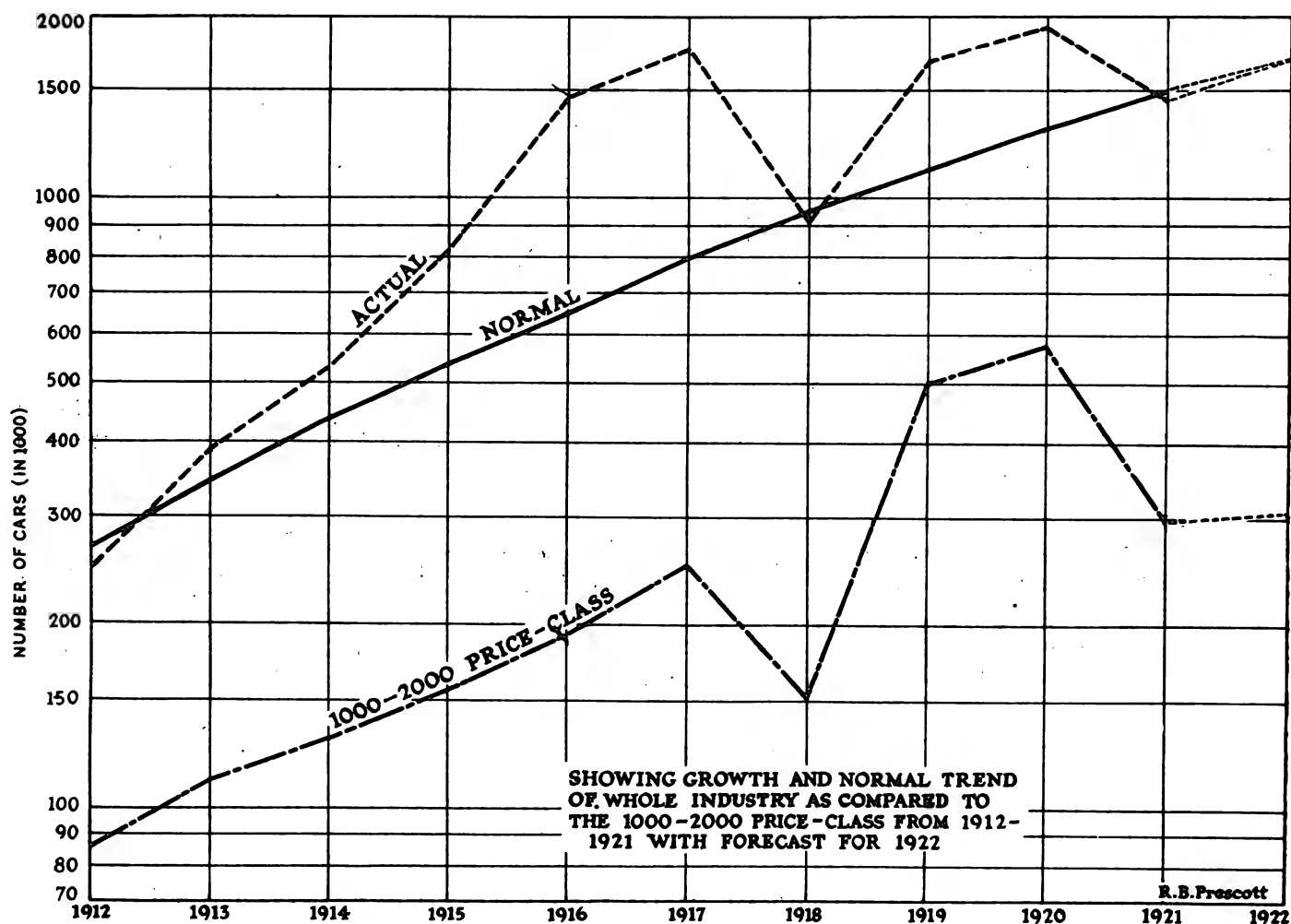


Fig. 1

course, is relative and not absolute; it has no bearing on the actual car production in this group.

A summary of the period 1912-1921 shows that 11,162,000 cars were produced, of which number 2,463,000, or about 22 per cent, were in the \$1,000-\$2,000 price class.

The tendency of middle-price production to decrease slightly in proportion to total production is particularly interesting, in view of the relative increase in the number of manufacturers making cars in this class. The curve in Fig. 2 shows this relation clearly.

It might be expected that, as the percentage of the total production comprised by this group dropped, the number of manufacturers in the group would drop also. As a matter of fact, just the opposite has occurred.

As the middle-price class percentage of total production dropped, the number of manufacturers entering the group increased. This was true during the period 1912 to 1916, during which the percentage steadily dropped. And the figures available for 1922 indicate a similar tendency at the present time.

This trend indicates a distinct increase in the competitive conditions of the middle-price class market at times when the potential market possibilities of the class are on the decline as compared with the total market. It indicates, as well, that those manufacturers who remained in the price group during the period when the percentage of business was increasing benefited in getting a stronger hold on the particular market.

This latter trend is illustrated by an analysis of the 1921 figures for this price group. These figures show

that, in 1921, 33 manufacturers in the middle-price group produced 291,432 cars, but that of this total, 80 per cent of the cars were produced by ten companies. A further examination shows that of these ten companies producing 80 per cent of the middle-price cars, nine of them have been constantly in this price group for five years.

The increase and decrease in middle-price percentage of total car production has been given to or taken from the "under \$1,000" group chiefly. In other words, the percentage decrease in the middle-price group from 1912 to 1917 was compensated chiefly by a percentage increase in the "under \$1,000" group, while the middle-price group percentage increase in 1918 to 1920 was accompanied by a loss in production percentage in the "under \$1,000" group.

The drop in the number of firms in the middle-price group in 1918-1920, on the other hand, occurred chiefly because of the jumping of many firms in the middle-price group to the high-price classes. The following table shows the movement of cars in and out of the middle-price class from 1912-1922:

	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922
Total in group.....	20	20	30	39	38	43	40	35	33	34	44
New cars	4	12	2	3	8	3	1	3	5	2	
From lower price group ..	0	1	1	0	2	5	4	3	0	0	
From higher price group ..	1	1	9	4	0	0	0	0	0	1	12
Out of business.....	4	1	2	1	2	3	2	2	1	1	
To lower price group ..	0	2	1	5	3	0	1	0	1	3	
To higher price group ..	1	1	0	2	0	8	7	6	3	0	

Studying the actual production figures of this group for a moment, it will be noted that the highest production for the group was in 1920, when 590,780 cars were pro-

duced. Not all of the companies in this price class in 1920 are still there in 1922, of course. But, figuring the 1920 production of the individual companies as their production capacity, the capacity of the 44 firms in the middle-price group in 1922 totals about 550,000. The calculated production in this group for 1922 is 306,000. Thus it appears that in 1922 the middle-price group will be operating at about 55 per cent of capacity.

This average, of course, is for the group as a whole and does not apply to particular firms, some of which will undoubtedly run much nearer to capacity, while some will have to operate at less than half capacity.

This completes the picture of the middle-price class group as a whole. The picture shows a field of intense competition, into which more cars have come during periods in which the field offered decreasing possibilities. It shows about 25 per cent of the companies in the field producing about 80 per cent of the cars, the remaining 75 per cent of the companies competing for 20 per cent of the potential middle-price class market.

Individual Problems

But the individual manufacturer is concerned with the relation of his particular company to the market, as well as to the price class market in general. His possibilities of obtaining more business rest in two points:

1. He must take away some of the business held by other manufacturers.
2. Or some companies must leave the field, thus increasing the possible sales for the remaining companies.

In considering the market possibilities for his particular car, the individual manufacturer must utilize, not only the statistical data presented, but also the principles upon which that data is built up. Experience shows, for instance, that a given company can scarcely expect to make radical changes in its trend of sales curve within a single year. Human nature is such that habit and inertia play a large part in buying and also in organization methods and ideas. Much progress can be expected within a single year or two, but radical changes cannot. A manufacturer can well base his plans for the coming years upon the trend of his sales curve in past years as related to the sales curve of his price group. It is this fact that makes the accompanying statistical data of value; that makes it possible to draw a sound, normal curve for the industry, and to predict with considerable accuracy the production and registration figures of the industry for two to five years in advance.

It is worth while to emphasize here again the necessity for those using these figures in planning to

be familiar with the data that has gone before and the basis upon which that data was built up. The two previous articles appeared in *AUTOMOTIVE INDUSTRIES* of Nov. 17 and Dec. 22, 1921, respectively.

Some Specific Examples

Fig. 3 shows the relation of six typical middle-price class cars to the progress of their price group. The cars chosen for this illustrative analysis have all remained in the middle-price class group throughout the period charted. Two of them are so-called assembled cars, while the other four are built up almost entirely within the manufacturer's own factory. An analysis of the chart brings out some interesting points.

Car A, for example, has had the largest production and has followed very closely the production trend of the entire price class. So striking is the similarity between A's curve and the price-class curve that A may be said to be a signpost to the probable trend of the entire group. The curve indicates that Company A has consistently maintained its relative position in respect to the price group of which it is a part, and that its production for the coming year will probably be about the same in relation to its past production as will be the total group production in relation to the past group total. In other words,

a company with a production curve similar to that of Company A can plan its production schedule with reasonable certainty on the assumption that it will at least maintain its relative position in its price group. The proportion might be stated in this way:

Company A 1922 production:Company A production capacity = middle-price group 1922 production:middle-price group capacity.

In most cases, however, the analysis is not quite so simple. Factors enter into consideration that cannot be accounted for purely on the basis of price-class market. The new car entering the field must take time to establish itself; change in policy and management may occur, necessitating temporary slowing up in production or readjustment in sales policy; internal financial battles may be waged with a consequent effect upon public

opinion and sales. All such factors must be considered by the individual manufacturer in making his analysis.

The production of Company B shows a somewhat different picture. This company made more rapid progress than its price group from 1912 to 1916, but since that time has not kept pace. It is worth while to note here, however, that a company may continue to be prosperous without keeping pace with the

STEADY profits are related to many factors other than quantity production. It is perfectly possible for a company to continue in a prosperous condition, although its production growth does not keep pace with that of its price class. The trend of individual production curves, however, as related to price class production curves constitute an important part of the market picture necessary in planning production and sales schedules.

Enthusiasm and optimism are essential parts of sales effort, but in buying equipment and materials, sound facts yield greater profits. The production schedule should be based upon what the individual manufacturer can reasonably expect as his proportion of his price class market. This article gives the statistics and methods necessary to a determination of that proportion.

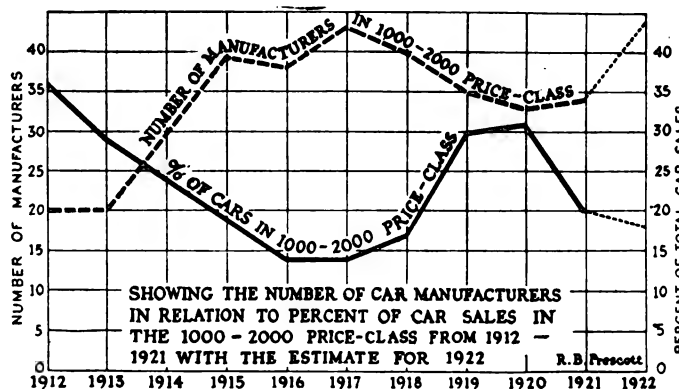
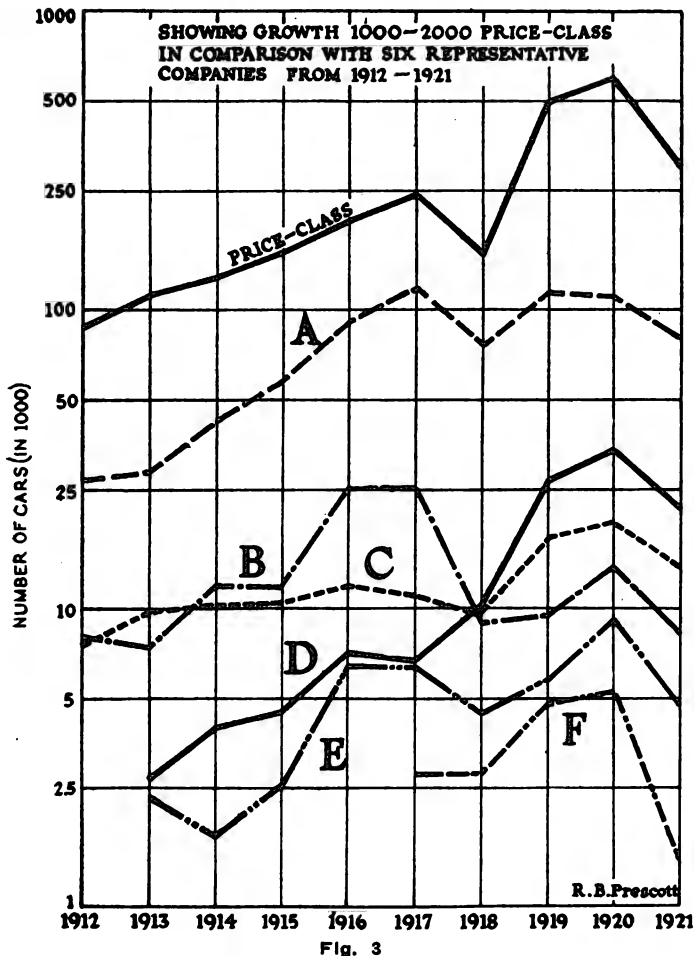


Fig. 2



growth of its price group. Steady profits are related to many factors other than quantity production.

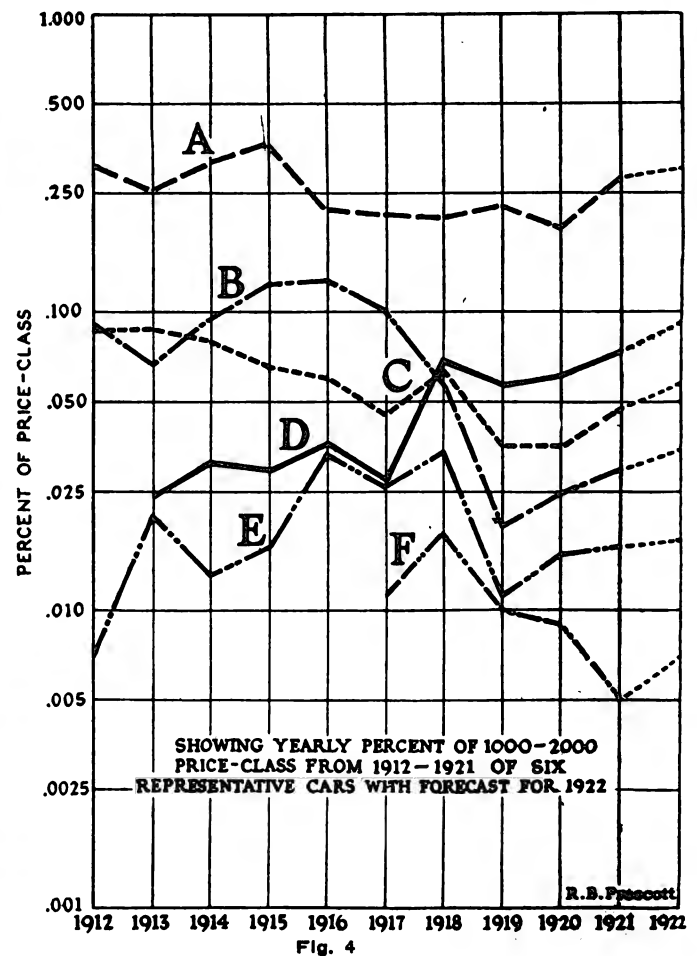
In the case of Company B, however, there would appear to be a production capacity in 1922 of some 16,800 in excess of actual production, thus indicating the necessity of either reducing the production capacity or obtaining a greater share of the price-class market that production may be increased. The trend of Company B's curve during the last five years does not indicate that there is a likelihood that Company B will be able to obtain that larger proportion of the market during the next year or two.

The curve for Company C shows a different condition again. Clearly, through the period charted, this company has failed to increase its production in proportion to the general increase of the price class. On the other hand, taking 1920 as its production capacity, there is not a large discrepancy, comparatively speaking, between its actual 1921 production and its production capacity.

Company D, according to the chart, is shown to have gained consistently at a more rapid rate than the middle-price group as a whole, while its 1921 figures show no abnormal drop from the 1920 capacity peak. On the basis of these records it would appear that Company D is the only one plotted which can logically expect to obtain a larger proportion of the business of the middle-price group during 1922 than it had during either 1921 or 1920.

Company E is shown to have gone forward with considerable rapidity during the early stages of its career—more rapidly than its price group as a whole. In later years, however, it has just about kept pace.

Company F came into the field later than the other companies charted. As might be expected, during its



period of growth it did not progress as rapidly as the group as a whole. It felt the effects of the business depression more heavily than did the companies more firmly established in the minds of the public, as is shown by the relatively sharp drop in 1921 production.

Fig. 4 shows the percentage of the total business of the price class obtained each year by these six typical companies. It gives in actual figures the general trend outlined.

Production and sales plans must be made upon the basis of real analysis and accurate data if permanent progress is to be made. In fact, such analysis is necessary if a company is to stay in business under present competitive conditions. Enthusiasm and optimism are essential parts of sales effort, but in buying equipment and materials sound facts yield greater profits.

It is human nature for every individual maker to feel that by more intensive sales methods he may be able to obtain this year a considerably larger share of his price-class market than ever before, and thus produce enough cars to cut down his overhead expense.

All the data and experience available, however, indicate that this is not probable in the case of any individual manufacturer—or in the case of any price class, for that matter. The data given by AUTOMOTIVE INDUSTRIES has been gathered over the entire period covered by the automobile industry, and can be said to picture with considerable accuracy the lessons and experience of the past and to form a basis upon which intelligent predictions for the near future can be made.

The production schedule should be based upon what the manufacturer can reasonably expect as his proportion of the price-class market, this proportion to be determined on the basis of the best available statistical data and financial situation of the individual company.

International Brings Out Advanced Design of Tractor

Employs one-piece frame, but maintains unusual degree of accessibility. Engine has two-bearing crankshaft, removable cylinder liners and overhead valves, all wearing parts being easily replaceable. Double reduction by bevel and spur gears to live rear axle. All gears run in bath of oil.

By Herbert Chase

ONE of the most interesting and advanced designs of farm tractor which has recently come to our notice is that developed by the International Harvester Co., which is to be known as the 15-30 gear drive model. This machine embodies many of the features of the most progressive designs which have appeared of late, and goes a step further than these in some directions.

The new product is of the one-piece cast frame type, and has a live rear axle and an automobile type front axle with single support at its center. One of the objects which the designers have sought to attain is an unusual degree of accessibility. The chief disadvantages of some machines with a one-piece frame is the fact that it has been rather difficult to dismantle them or reach various parts when repairs are required. In this new product, however, most of the units, such as the gearset, the clutch, the axle gears and the belt pulley drive, can be readily taken out without disturbing, except in a minor way, adjacent units. Furthermore, the design is such that the various parts can be removed and dismantled with minimum expenditure of time.

The new tractor has a wheelbase of 85 in., rear wheel tread of 50 in., front wheel tread of 46 in. and a turning radius of 15 ft. It weighs 5575 lb. filled, 3325 lb. being on the rear wheels and 2250 lb. on the front wheels.

Among the unusual features of this tractor is the use of a two-bearing crankshaft and a main casting which

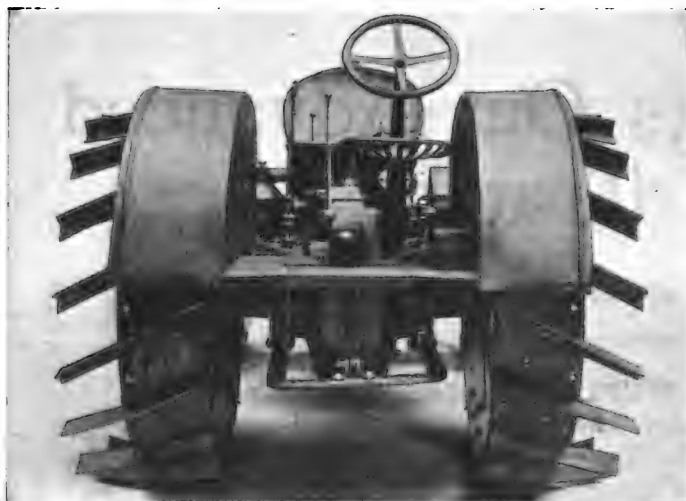
carries the removable cylinder sleeves and includes both upper and lower halves of the crankcase. The crankshaft is supported in two large annular ball bearings. The connecting rods can be inspected by removing hand hole covers at the side of the case and are easily adjusted after removing the crankcase pan. The cylinder head is detachable, and is used to hold the separate cylinder liners in place. Against the latter bear rubber gaskets, which make a water-tight jacket joint. Aside from the features mentioned, the engine is more or less conventional in general design. It has a $4\frac{1}{2}$ -in. bore and 6-in. stroke and is governed to run normally at 1000 r.p.m. Overhead valves are employed. They are operated by rocker arms and pushrods from the camshaft in the crankcase. Oil troughs above the rocker arms provide lubrication through wicking. The removable sleeves are machined inside and out, and can be easily replaced when worn or scored, as can all other wearing parts of the engine.

The connecting rod bearings are bronze-backed, bab-bitt-lined and measure $2\frac{7}{8}$ in. diameter by 3 in. long. The crankshaft is heavily constructed to give adequate stiffness. The connecting rods have a conventional H-section and carry a solid bronze piston pin bushing. The pins are $1\frac{1}{2}$ in. in diameter and are locked securely into the pistons. The latter are $5\frac{7}{8}$ in. long and equipped with four rings, all located above the piston pin.

Lubrication is by splash, the oil being raised from the sump to the oil pan by a gear pump driven by a vertical



Front and side views of 15-30 gear drive International tractor, showing one-piece frame, pivoted on front axle, wishbone and location of belt pulley and air cleaner



Rear view of new International tractor, showing power take-off on upper axle housing and adjustable drawbar

shaft off the camshaft. An oil gage, located on the dash, enables the operator to determine whether or not the oil is circulating properly.

All working parts of the engine are completely inclosed, so that the exterior has a clean appearance. The exhaust manifold at the left side of the engine is bent downward and terminates in a short pipe projecting through the lower edge of the hood. The air cleaner is mounted at the left side of the frame outside and just back of hood. It is connected to an Ensign carburetor which delivers the mixture through a short riser to the exhaust-heated inlet manifold, which is cast in

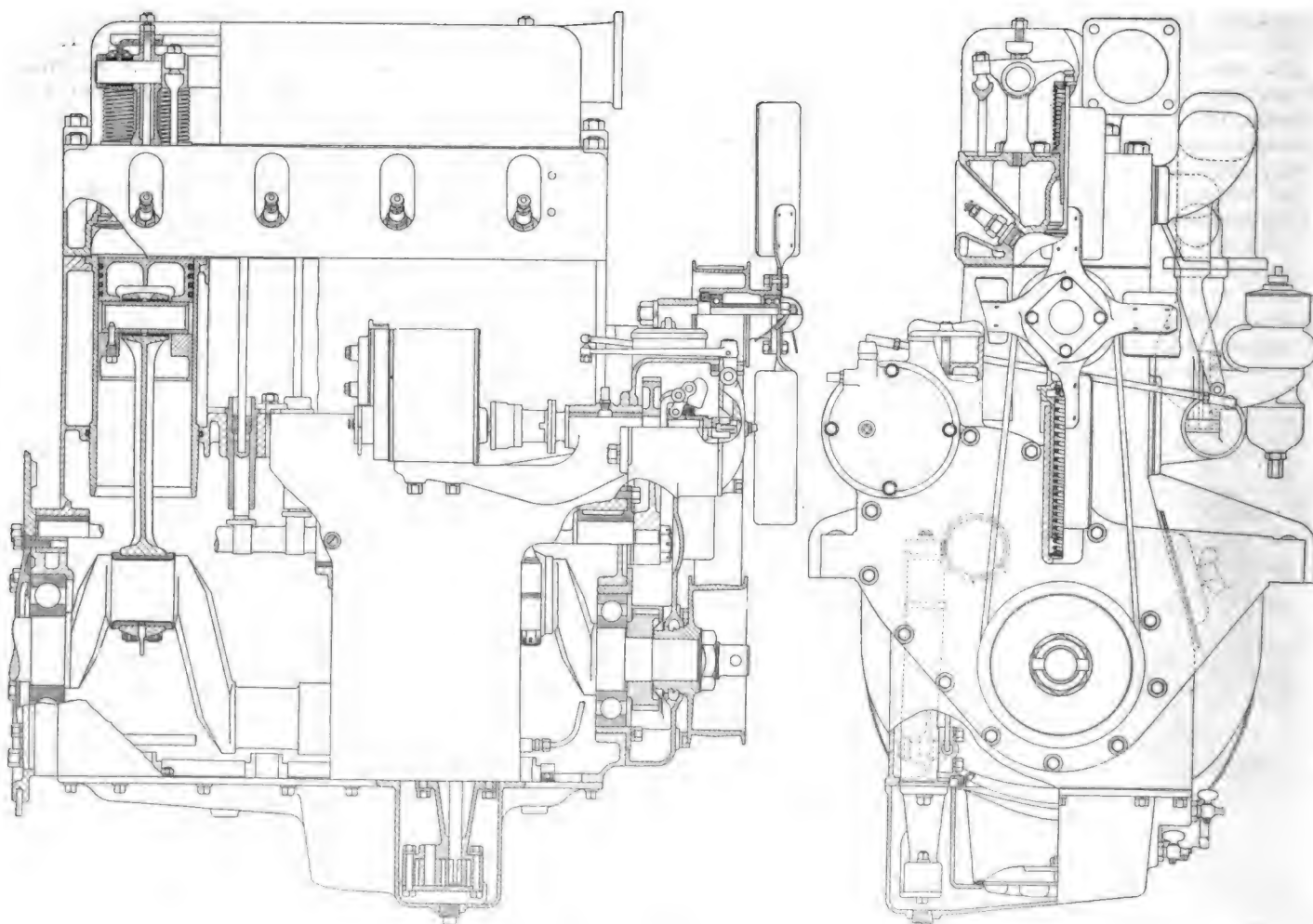
one piece with the exhaust header. This fuel system is designed to handle either gasoline or kerosene, tanks for both being provided. A centrifugal throttling type governor, driven off the magneto shaft, is employed. A high-tension magneto with impulse starter is fitted.

The Clutch and Gearset

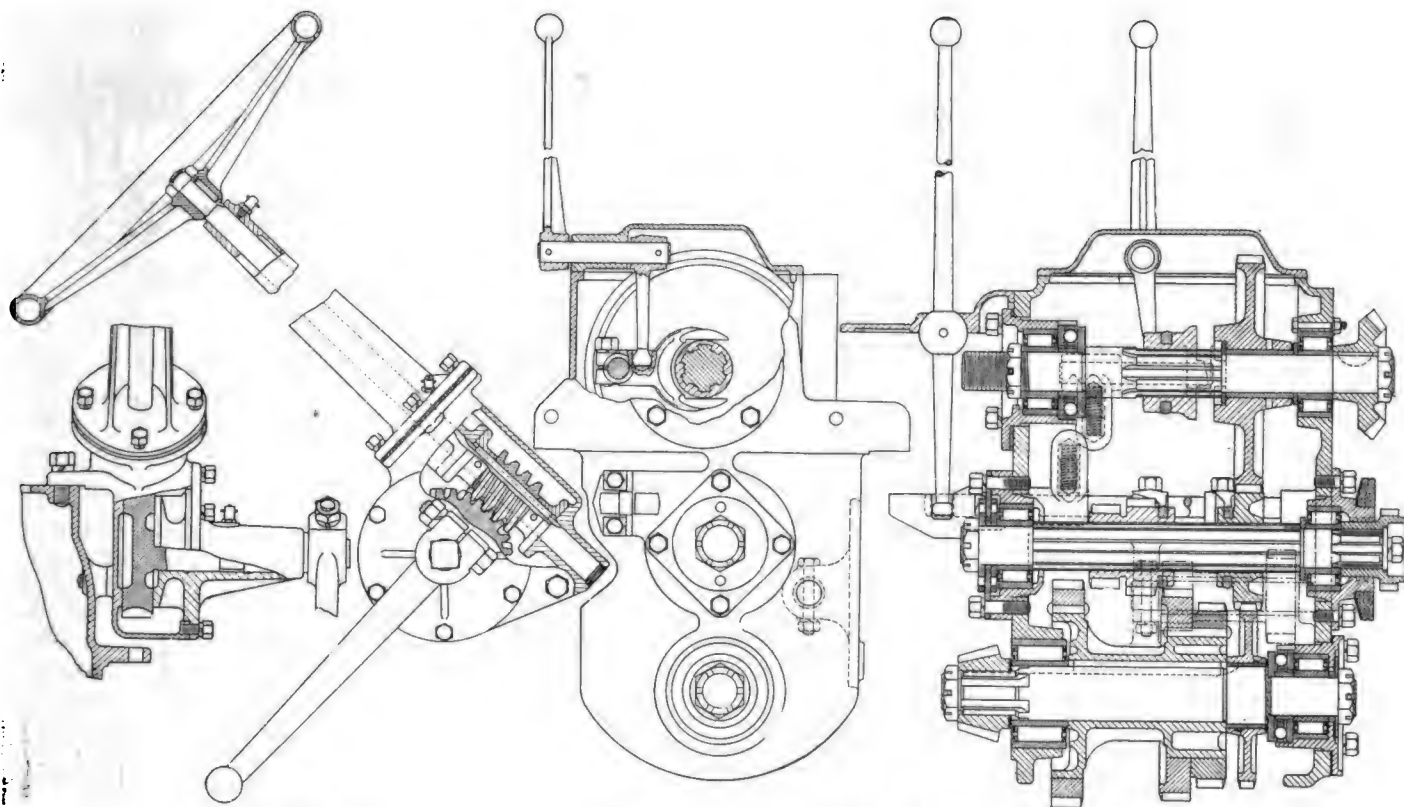
The clutch is of the multiple dry disk type, driven by pins bolted to the flywheel flange. The driven member is piloted on a short extension of the crankshaft which carries an annular ball-bearing. From this point the drive is taken through a short splined shaft, which is integral with the external half of a semi-flexible joint of the internal-external gear type. An annular throwout bearing is carried in a housing with a friction surface which acts as a clutch brake. There are six driving and five driven disks. The design of the clutch is so worked out as to permit of its removal without disturbing either the engine or the gearset.

Directly back of the clutch and driven through the semi-flexible joint referred to is the gearset, mounted in a removable carrier which seats in the main frame casting. This gearset is similar in general construction to that used in automobile practice, the speed changes being accomplished by sliding gears on a splined countershaft. The shafts are mounted on hardened roller bearings, which, in common with similar roller bearings used in other locations, are the product of the International Harvester Corp. Where bevel gears are employed, ball thrust bearings are used.

The belt pulley assembly is a separate unit, mounted in a separate and easily disconnected housing on top of the main frame casting and driven by bevel gears



Part sectional views of engine, showing two-bearing crankshaft



At right, the gearset used in the new International tractor. The central shaft is driven by the engine. It drives in turn either the lower shaft, which is geared to the bull pinion shaft, or the upper shaft, which drives the belt pulley. At left the worm and wheel steering gear

from the upper shaft of the gearset. The shaft carrying the belt pulley is mounted in roller bearings, with its axis at right angles to that of the crankshaft. The belt pulley drive gear is provided with a solid jaw clutch which permits of disengaging the pulley shaft. When this clutch is engaged, the belt pulley is operated through the main multiple disk clutch. The belt pulley is so located at the side of the tractor as to give ample clearance for the belt, both at the side and above the front axle. The pulley is 16¼ in. in diameter and runs normally at 595 r.p.m., giving a belt speed of 2530 ft. per minute.

Final Reduction Gears

Just aft of the change speed gear, mounted in the main frame casting and driven by a bevel pinion and ring rear from the lower shaft of the gearset, is the bull pinion shaft. This is short and heavy and is mounted in roller bearings. It can be removed through the side wall of the main frame without disturbing other units. Mounted on the bull pinion shaft, outside the frame, is a brake drum to which is fitted a substantial band brake operated by a hand lever.

The bull gear and differential are mounted in the main frame casting and tubular extension attached to it. The differential housing and rear axle are carried on roller bearings. The wheels are keyed and clamped to the live rear axle shafts, which latter are provided with hardened steel flanges arranged to take end thrust. These flanges are carried between the main casing and the removable bearing caps or flanges. The wheel and axle can be easily removed by taking out eight flange bolts. The bull gear and differential can then be taken off the frame case, the cover of which is readily removed.

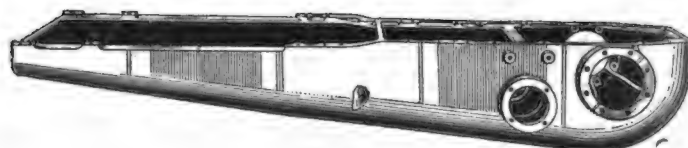
All of the gears in the entire transmission are of steel, carbonized and hardened. The main gears are made from steel rings, which are fastened separately to the carriers so that replacement can be made at minimum

expense. All of the transmission bearings, except those on the reverse idler, and the ball thrust bearings, are of the roller type. The entire transmission (gearset, bull gears, bevel gears and differential) runs in a bath of oil which is continuously circulated by the action of the gears.

Special Power Take-off

The tractor is designed to receive a special power take-off, driven from the engine through the transmission. This take-off terminates in a shaft carried in the upper half of the differential casing, and is made accessible by removing a small end cover. This is a special feature which can be readily attached and is expected to find many uses for driving parts of trailing machines of the same general character as those which are now frequently drawn by tractors, but which are now, in general, operated through power taken from driving wheels in contact with the ground. Other accessories, such as power winches, can also be driven from this take-off. An adjustable drawbar is attached to the main frame and axle housing.

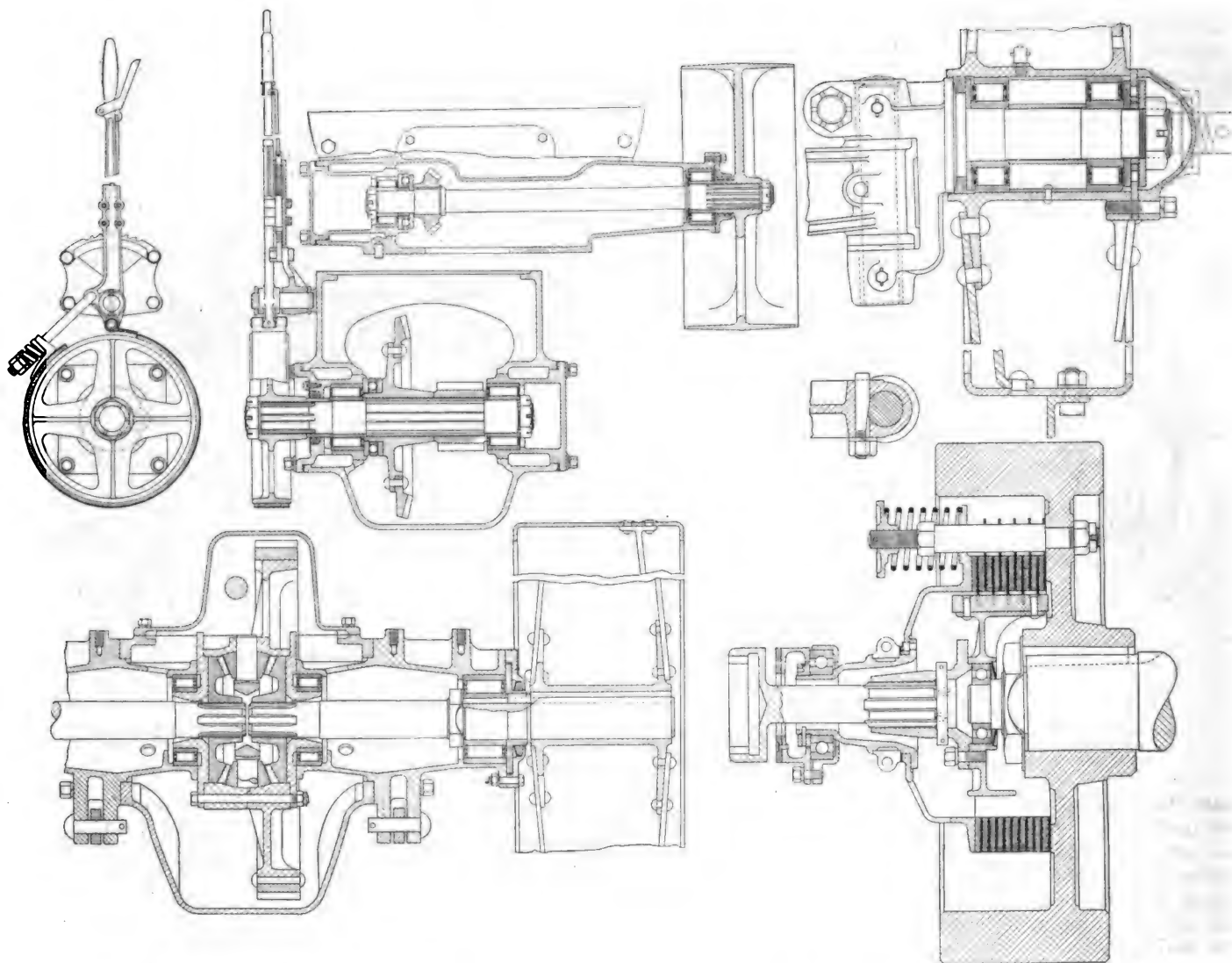
The rear tractor wheels are 50-in. diameter by 12-in. face, and the gear reductions on the three forward



Cast one-piece frame, showing large openings which render all parts easily accessible

speeds are such as to give the machine a speed of 2, 3 and 4 miles per hour respectively. Gear shifting is accomplished in the same manner as in passenger car and truck practice.

The steering gear is of the worm and wheel type, both worm and wheel being of hardened steel. Suitable thrust



Parts of International gear drive tractor: Above, at right, section of front wheel hub; center, belt pulley with its bevel gear drive; at left, bull pinion shaft and hand brake, which acts upon it. Below, at right, the multiple disk clutch; at left, section of rear axle, showing bull gear, differential, thrust flanges, live axle and wheel.

bearings and an 18-in. cast iron steering wheel are provided. The worm wheel is on a horizontal shaft, and the steering arm normally occupies a vertical position. It is connected to the right steering knuckle by a long drag link and thence to the left steering knuckle by a cross link in back of the axle.

The drop-forged front axle is of I-beam section, tapered from center toward the end. The front end of the frame is pivoted at the center of the axle, which is thus capable of considerable angular motions in reference to the frame, without distortion of the latter.

The axle is held rigidly against fore and aft motion by a heavy fork or "wishbone" bolted rigidly to the axle, but pivoted in a ball and socket joint attached to the under side of the main frame.

The front wheels run on roller bearings carried on

spindles integral with the steering knuckles, similar to automobile practice, except that a hardened steel flange is used to take thrust, in the manner shown in the accompanying cut. The pivot pins are bronzed bushed. The front wheels are 34-in. diameter by 6-in. face and are fitted with removable skid rings. The spindle of the right front wheel is extended through the hub to carry the self-steering device when this accessory is used.

The controls of the machine, which are quite similar in most respects to those used in automobile practice, are placed within easy reach of the driver. Substantial shields are provided over the rear wheels. Extension flanges and an assortment of lugs to suit various soil conditions are supplied when desired.

The few parts outside the main frame which require lubrication are fitted with Alemite connections.

Cast Iron Cutting by Oxy-Acetylene Flame

CAST IRON cutting by the oxy-acetylene flame is an interesting development of the last two years. The cast iron must be preheated to redness over a considerable space. A large and powerful oxygen jet is then directed on the red hot cast iron, with the preheating continued. The kerf made in the iron casting is quite similar to that made in cutting of steel, except that its width is generally

double that in a similar sized steel casting and it is not quite so clean looking. It is plain that more gases are used than in similar steel cutting, and it has been noted in tests that the time for cutting is about double that in the case of steel; therefore, cast iron cutting is three or four times as costly as steel cutting and in normal work it can hardly be said to compete with saws.

White Chassis Designed Especially for Bus Service

New product is provided with special, long, low hung frame with out-riggers to support body, long flat springs, 50 h.p. engine and double band propeller shaft brake. Steel wheels with solid tires, or disk wheels with pneumatics can be supplied without variation in height of chassis frame.

By J. Edward Schipper

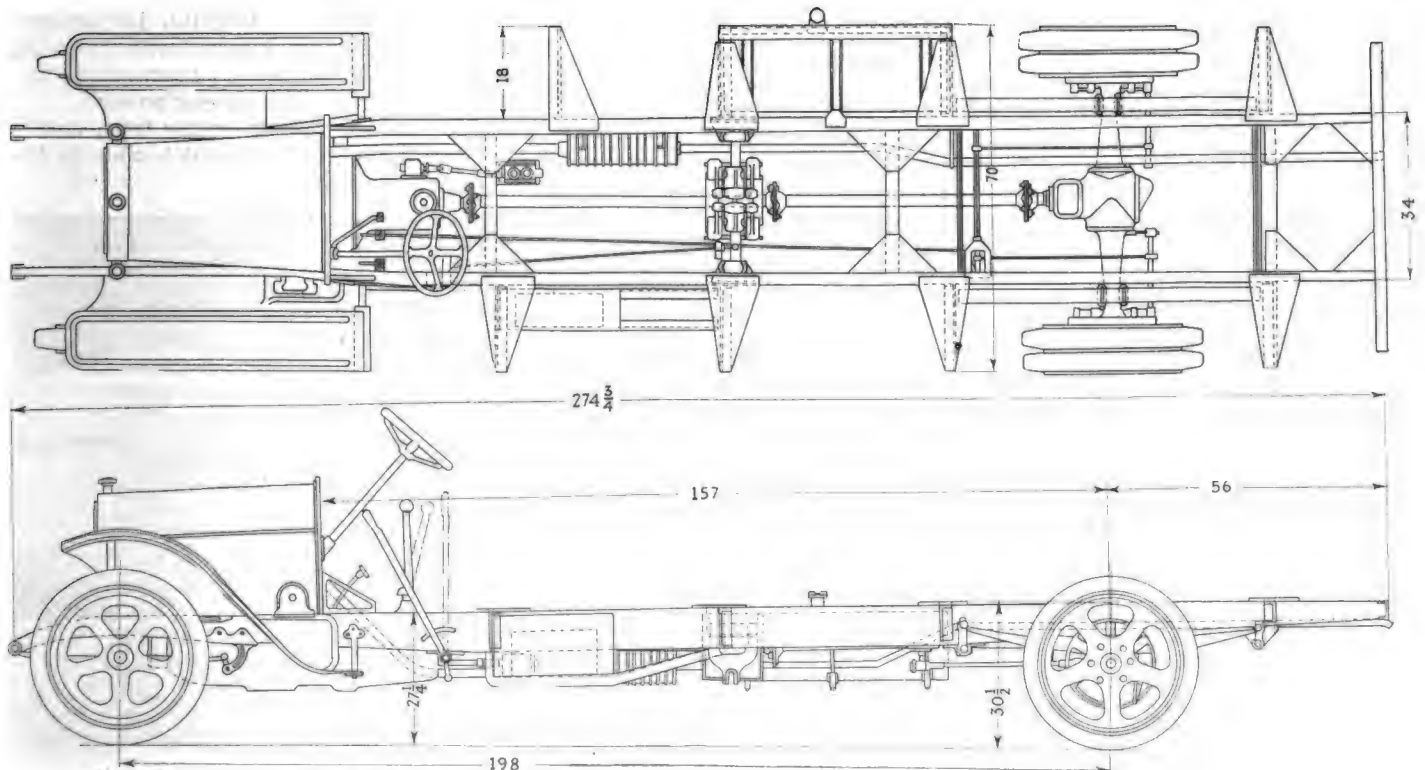
A CHASSIS which has been designed specifically for bus service, either in urban or interurban work, has been brought out by the White Co., and has already been put in use in different parts of the country. The chassis is known as Model 50, and it is particularly interesting in view of the fact that it is not a modification of any particular model of White truck chassis, but is designed especially for bus service. A number of features which are important in passenger carrying and are not generally found in the conventional type of truck chassis have been incorporated. As compared with the usual truck chassis, this particular bus chassis has a longer frame, a lower platform height, increased riding comfort and a wider range of speed and acceleration. The chassis frame is designed with sufficient length to mount a body seating 25 passengers without undue overhang. The wheelbase is 198 in., while the overall length of the chassis is 276 in., and the overhang at the rear end is only 56 in. measured from the center line of the rear axle.

Keeping the loading height of the frame down permits passengers to enter and leave more rapidly and is claimed to have a material effect on the length of stops and, con-

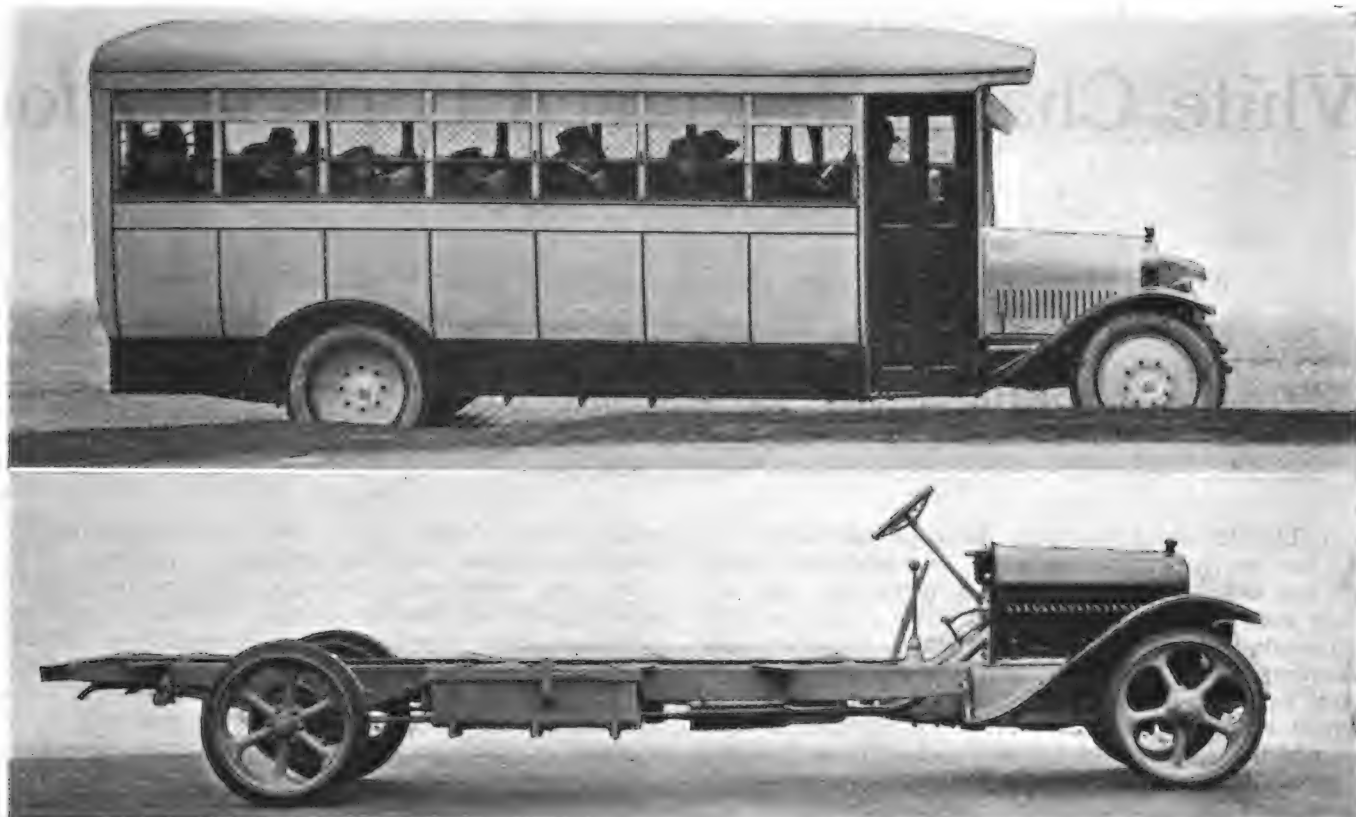
sequently, to provide for a faster schedule without increasing the speed when the vehicle is in motion.

The long wheelbase, low frame, giving a low center of gravity, and long flexible springs, combine to give easy riding qualities. The front springs are 41½ in. in length by 2½ in. wide and have seven leaves. The rear springs are 60 in. long by 3 in. wide and have sixteen leaves. Both the front and rear springs are exceptionally flat for a vehicle of this character.

To provide for a wide range of speed and acceleration, optional gear ratios and transmission ratio combinations are provided to meet the requirements of the particular service. The chassis layout is such that either of two types of wheel and tire equipment can be provided. Steel wheels and solid tires are standard equipment and are especially adapted to operation on paved city streets. For interurban work, pneumatic tires mounted on Budd-Michelin dual disk wheels are available. The use of pneumatic tires does not increase the frame height nor raise the center of gravity on this installation because of the dual arrangement which permits of moderate tire diameter.



White bus chassis showing frame structure and out-riggers for supporting tank, battery and body



(Above)—Brown twenty-five passenger bus body mounted on White model 50 bus chassis. (Below)—Side view of White model 50 chassis designed exclusively for bus service

The chassis weight averages about 5400 lb., but varies with the equipment. The pressed steel frame has a maximum depth of 8 in. at the center. The frame width is 34 in. and the height from the ground $28\frac{1}{4}$ in. without load at the door position. The standard gear ratio provided is 6.8 to 1, with an option of 7.5 to 1. The tire equipment, standard, is 36 by 4 in. single front with rear 36 by 4 in. dual, or 36 by 7 in. single. The dual disk steel wheels used with pneumatic tires take 36 by 6 in. dual in rear and 36 by 6 in. single front.

The engine employed is rated at 50 hp. and has a bore and stroke of $4\frac{1}{4}$ x $5\frac{3}{4}$ in. The engine, clutch and transmission are embodied in a unit powerplant. The clutch is a single plate type operating in oil and the gearset is of selective type with four speeds forward and one reverse. In some cases, especially where both city and rural service is provided, the gearset is arranged for direct drive on third, and has an overgeared fourth speed.

Ignition is by magneto. Lubrication by pressure feed and cooling by centrifugal pump through a cellular radiator. Fuel is fed by a vacuum system from a 35-gal. tank mounted on the right side of the chassis frame. The engine speed is limited to 1550 r.p.m. by use of the Standard White governor.

The truck is driven by a divided propeller shaft having one telescopic joint and two universals. The foot-operated service brake acts upon drums on the driveshaft being supported by a cross-member of the frame, as shown in one of the accompanying cuts. The internal expanding emergency brake, operated by a hand lever, acts upon rear wheel drums.

An interesting point in connection with the flexible spring suspension is that in order to keep the weights in balance on the bus, the battery is hung on left hand outriggers, while the gasoline tank is supported from outriggers on the right side of the chassis frame.

The rear axle employed is similar to that used on the Model 20 two-ton White truck, but only one set of

brakes, the internal expanding set, is employed. This axle is of the double reduction type. The road clearance is $10\frac{1}{2}$ in. and the gage $60\frac{1}{2}$ in. The front axle is also similar in design to that used in the two-ton truck, but is given a slightly greater drop to facilitate lowering of the frame.

Standard equipment includes a 12-volt. Leece-Neville lighting generator driven direct from the timing gears of the engine, and in tandem with the magneto, which is driven off the generator shaft. A 13-plate, 120 ampere hr. battery is also furnished. A Leece-Neville starting motor, with Bendix drive to flywheel, is mounted on the clutch housing when furnished as extra equipment.

The radiator is described as a touring car type, and is formed to accommodate a sloping hood, which adds to the appearance of the completed vehicle.



Service brakes on White bus chassis mounted on the propeller shaft at the point of its division

Experience in Development of Cylinders for Air-Cooled Engines

An accumulation of data collected as a result of experimental and design work relating especially to cylinders of high output. The advantages and disadvantages of various types of fins, valves and valve seats, cylinder heads and cylinder material are discussed by a student of this subject.

By S. D. Heron*

IT is proposed to review some of the salient points arising in the design and development of the modern air-cooled cylinder of high output. Investigation has shown that for every brake horsepower developed an average of approximately 0.6 hp., or 25 B.t.u. per min., has to be dissipated directly to the cooling air by the external cooling surface of the cylinder. In addition, 0.4 to 0.5 hp. has to be dissipated by the oil, by conduction to and radiation from the crankcase and similar means. The amount of heat absorbed by the oil will depend largely upon the amount reaching the cylinder and the piston walls and the facilities for cooling the oil. Power output, fuel consumption and cylinder-wall temperatures, such as are quoted herein, are dependent upon liberal splash lubrication and the resultant oil-cooling.

In the light of present-day knowledge a design for a cylinder of high output has to fulfill approximately the following requirements:

- 1—Develop a volumetric efficiency of 80 to 85 per cent.
- 2—Produce a brake mean effective pressure of at least 130 lb. per sq. in. at the normal speed on a maximum fuel consumption of 0.56 per b. hp. hr.
- 3—Dissipate 25 B.t.u. per min. per b. hp. from the external cooling surfaces of cylinder, this heat to be dissipated so that the maximum temperature of any portion of the exterior of the cylinder walls does not exceed 550 deg. Fahr., and is preferably lower. In addition, the mean temperature of the exterior of the cylinder walls should not exceed 350 deg. Fahr. To produce a layout that fulfills the stated requirements it is necessary that heat-flow be the primary point in mind during design.

The Supply of Cooling Air

As the amount of heat lost to the walls from the charge differs largely in various parts of the cylinder, it is obvious that to have anything like even temperature distribution, the supply of cooling air to any portion of the cylinder should be proportioned approximately to the amount of heat given to that portion of the cylinder.

Considering a normal design of overhead valve cylinder with circumferential cooling fins, it is evident that the side of the cylinder head and barrel that carries the exhaust ports will receive the greatest heat supply per unit area, and therefore should receive the major portion and the greatest effect of the cooling air supply. This requirement is suitably met by applying the cooling blast on the exhaust side of the cylinder. In practice, with such blast application, the circumferential temperature difference at the top of the cylindrical portion of the combustion chamber will not exceed 50 deg. Fahr. Toward the base

of the cylinder the circumferential temperature differences will probably increase, but this is usually of little moment, since the maximum temperatures attained there are low. Contrary to the opinion commonly held in this country, the back or side of the cylinder that is in the lee of the blast does not give overheating trouble when the cylinder design is sound and the air supply is suitably arranged.

Cylinder Design

The aim in design should be to remove as far as possible the heat from the cylinder at the point where it is given to the head, ports and barrel. Investigation has demonstrated that neither a material of high conductivity nor an excessive cooling air supply will remedy poor design. A simple cast-iron cylinder with only a small cooling air supply but fulfilling some of the fundamental necessities for efficient heat dissipation will give a performance much superior to that of designs that presume to function by high wall or fin conductivity in conjunction with large quantities of air supplied to those portions of the cylinder where little is needed and a total lack of effective air supply where it is required.

The temperature of an air-cooled engine is determined by the cooling air temperature as a datum point. If the air temperature rises 50 deg. Fahr. the actual cylinder temperatures are sensibly increased by that amount. In general, with an efficient cylinder design, the effect of the air temperature is little felt. A considerable rise in the air temperature increases the cylinder temperature, but it simultaneously reduces the charge weight, and thus to some extent the heat to be dissipated by the cylinder is diminished. A variation of 350 deg. Fahr. in maximum cylinder temperature at full throttle is permissible for short periods of time, such as exist during a fast steep climb by an airplane or the ascent of a mountain by an air-cooled car. That cylinder temperature control is necessary for air-cooled aircraft engines has yet to be proved in practice, although urged as a disadvantage of air-cooling by its opponents. The stabilization of the carburetor temperature is much more likely to be found necessary, due to the rapidity with which an air-cooled engine cools during a glide or dive when switched off or idling.

Many designs have been proposed and many built in which the ingoing charge is presumed to cool the various parts of the cylinder, usually the exhaust valves and exhaust ports. In practice such designs do not function, little or no cooling from the ingoing charge is obtained, and the general result is usually a marked reduction in the volumetric efficiency, accompanied by a pronounced overheating. The ratio between the amount of air required

*Condensed from a paper presented before the Dayton Section of the Society of Automotive Engineers. The author is attached to the Engineering Division of Air Service, U. S. Army.

for cooling and that used for combustion serves to show the unsoundness of attempts to use the ingoing charge for cooling. Further, the cylinder is not the correct place to apply heat to the charge, as heat supplied there can have no beneficial effect on the distribution.

In calculating the air required for combustion a brake mean effective pressure of 130 lb. per sq. in. and an 85 per

heat accumulator, is known to be of advantage in preventing boiling in mountainous country. This is a parallel tending to show the similar advantage of thick, heavy cylinders for air-cooled engines.

Assuming the average brake horsepower as 10, the mean temperature rise of the cylinder bodies as 100 deg. Fahr. and the weight of the two cylinder bodies as 44 lb.; the heat given to cylinders during the climb is 2750 B.t.u. The heat storage of the cylinders for a given temperature rise equals the product of the weight of the cylinder bodies, the specific heat of the material and the temperature rise, or $44 \times 0.12 \times 100 = 528$ B.t.u. Therefore, 19 per cent of the heat given to the cylinders during the climb was stored therein. This calculation is, of course, only approximate. The assumption as to the brake horsepower and the mean temperature rise of the cylinders are reasonably sound, and even if inaccurate the result serves to show the advantages of heavy cylinders with large heat storage capacity for engines depending almost entirely on radiation for cooling during limited periods of full throttle operation.

Results of Correct Design

A cylinder of sound design, when running at its most suitable compression ratio, will usually develop its maximum power, maximum cylinder wall temperature and maximum tendency to detonation when the air-fuel ratio, by weight, for gasoline and gasoline-benzol mixtures is between 12 and 13 to 1. This mixture strength gives approximately the maximum rate of flame propagation. A mixture strength of 12 or 13 to 1 by weight, when used in a composite aluminum and steel aircraft cylinder, usually results in a fuel consumption of approximately 0.55 lb. per b. hp. hr. with aviation gasoline or aviation gasoline and benzol. This, however, only applies at the most suitable compression ratio. If the ratio be too high, fuel consumptions have to be increased to eliminate detonation. That a fuel consumption of approximately 0.55 lb. per b. hp. hr. usually produces the maximum power and the maximum cylinder temperature is confirmed by Table 1.

The minimum fuel consumption that an air-cooled cylinder will run on is generally a measure of its soundness. In this respect a rather curious difference is noticeable between efficient and unsound design. A poor design will usually work over a wide range of fuel consumption, say from 0.7 to over 1.0 lb. per b. hp. hr. without much variation in the power output, whereas an efficient design

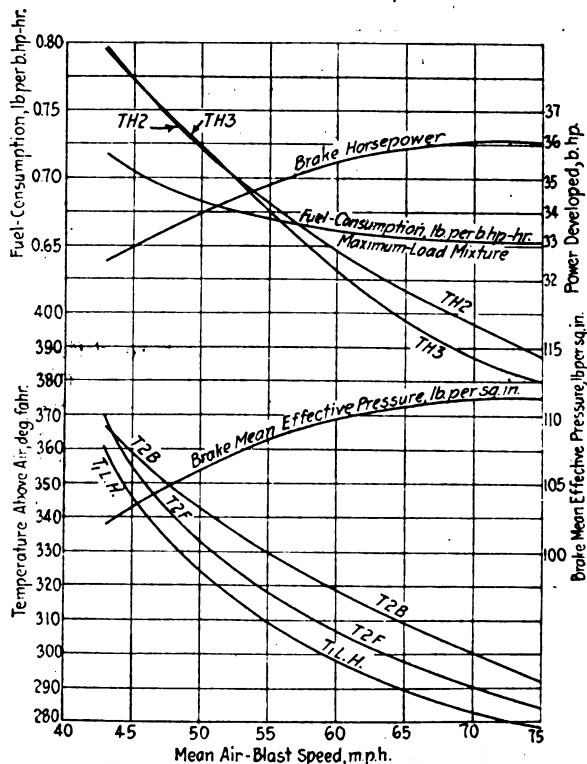


Fig. 1—Effect of the variation of blast velocity upon the temperature and fuel consumption of the Alcoa cylinder

cent volumetric efficiency in terms of air at the carburetor mouth are assumed. This brake mean effective pressure almost exactly equals 6.1 cu. in. of cylinder capacity per brake horsepower in a four-cycle engine running at 1000 r.p.m. The volume of air per brake horsepower per minute required for combustion is 1.5 cu. ft. and the ratio between the air required for cooling and that needed for combustion is 24.5:1. Although less than 36.7 cu. ft. of cooling air per brake horsepower can be used, and the foregoing calculation takes no account of the cooling effect derived from the latent heat of the unevaporated fuel, nevertheless it gives a measure of the unsoundness of a method of cooling so attractive to many.

An example of what may be accomplished in the way of automobile engine cooling with small air supply is shown by the B. S. A. light car. This car has a 90 deg., two-cylinder V-engine of 66 cu. in. capacity and is cooled entirely by natural draft, no fan being employed. One of the early engines was fitted to a car weighing 1700 lb., including passengers and regular equipment, and road tests of the cylinder temperature under these conditions are of interest. Climbing a hill rising 1200 ft. in $2\frac{1}{2}$ miles, the temperature at the hottest point of the hottest cylinder was 310 deg. Fahr. above the air temperature at the start of the ascent and 495 deg. Fahr. at the finish. This ascent was taken on the run with the engine at normal temperature and was made in a following wind in 11 min. There is little question that the heat-storage capacity of the cylinders is of considerable importance in preventing overheating under such conditions. The heat storage capacity of a water-cooled engine having a large quantity of water in the jackets and the radiator, in this sense a

Table 1—Effect of Mixture Strength on Cylinder Temperatures

Power Developed, B. hp.	Fuel Consumption, b. hp. hr.	Air-Fuel Ratio by Weight	Cylinder Head Temperature Rise Above Air, Deg. Fahr.
32.8	0.70	10.5	319
33.2	0.64	11.4	345
33.3	0.57	12.9	385
32.9	0.54	13.5	371
30.6	0.51	15.4	345

will generally show a drop in the power output if the fuel consumption at maximum load of approximately 0.55 lb. be increased by about 15 per cent, the power progressively decreasing with a further increase of the mixture strength.

The reduction in the cylinder wall temperature obtained when the mixture strength is enriched beyond 12 or 13 to 1 may be attributed to the increase of internal cooling by the evaporation of liquid fuel particles and to the reduction of both the rate of flame propagation and the flame temperature.

The circumferential fin, on the whole, appears to have the majority of the advantages. It gives a considerable

stiffening effect to the cylinder that is of advantage in resisting distortion under temperature, explosion and bending stresses. Circumferential finning in general simplifies the problem of best applying the air supply to the cylinders. A combination of circumferential fins for the barrel and the cylindrical portion of the head with circumferential and axial fins or axial fins alone for the crown is used at times and is practically essential for four valve roof head types.

Cylinder Head Design

In general the work on which this paper is based shows that the flat head does not compare favorably, as regards either power output or cooling efficiency, with the spherical or roof types. The reasons for this are plain in my opinion. In the first place, the flat head renders it difficult to maintain the required air spaces between the valve ports and the necessary metal sections between the valve seats without reducing the valve sizes excessively. Large air spaces between the inlet and exhaust valve ports are desirable with three or four valve designs employing a pair of exhaust valves, and it is essential to have a minimum air space of $\frac{3}{4}$ in. between the adjacent exhaust port walls in such types. Further, with aluminum heads, it is necessary to maintain approximately $\frac{5}{8}$ in. as a minimum section of aluminum between adjacent exhaust valve seat inserts; otherwise overheating, distortion and cracking will be apt to occur. It is not wise to reduce this section much between pairs of inlet seats or between adjacent exhaust and inlet seat inserts.

The discharge of an inclined valve in a spherical or roof head appears to be much less disturbed and more likely to promote and maintain turbulence than that of a similar valve in a flat head. The flat head is more liable to deflect under explosion pressure and, in practice, breathing of flat heads is by no means unknown. The truly hemispherical head is the ideal form as regards minimum stress due to explosion pressure.

For two-valve designs the spherical head appears to be the most suitable. For four-valve heads the spherical head is undoubtedly the most efficient, but, except for very special cases, its use does not appear to be justified, owing to the manifest difficulties of valve operation and also to the fact that excellent results are obtainable from a suitably designed roof head. When, however, very large cylinders are required, or medium size designs, either of large bore stroke ratio or to run at such high speeds that sufficient valving in conjunction with good cooling cannot be obtained with a roof head, there is little question that the spherical head is the most suitable design.

Experience to date indicates that for aircraft engine cylinders up to about 170 cu. in. capacity and with bore-stroke ratios not exceeding 1.25 to 1, designed for normal speeds of up to 1800 r.p.m., the roof head will produce the best all-around results. The design of an efficient roof head cylinder is, however, a decidedly tricky proceeding, slight faults in detail being liable to result in poor cooling.

Advantage of High Compression

Relatively high compression is of considerable advantage for air-cooling. It is not likely that any further considerable increase of the possible compression ratio with present aircraft fuel can be secured by any improvement in the design. It is probable, however, that the use of fuel dopes will render possible a further considerable increase. This has been investigated on small air-cooled aircraft engine cylinders and medium size water-cooled aircraft engines: the results have shown a considerable increase in the brake mean effective pressure. Should the proportionate increase of performance prove as large with 160 cu. in. air-cooled cylinders as has been found with the

70 cu. in. types, some rather remarkable performances are likely to be produced in the near future.

Investigation has shown that a steel surface gives 5 to 10 per cent greater heat dissipation than either aluminum or copper. The dissipation of aluminum, however, is improved about 10 per cent by coating with a glossy black enamel, the percentage of improvement varying with the nature of the enamel and the blast velocity. The effect of surface dissipation is of considerable importance and further investigation of the subject is to be made by the Bureau of Standards and the Engineering Division of the Air Service.

The principal alloy that has been used by the British for air-cooled cylinder construction is the Air Ministry 2-L-11 alloy, containing 7 per cent of copper, 1 per cent of tin and 92 per cent of aluminum. This was developed after failure had attended efforts to use the aluminum zinc group, employed so largely on the Continent for crankcase and similar parts. This alloy is both weak and

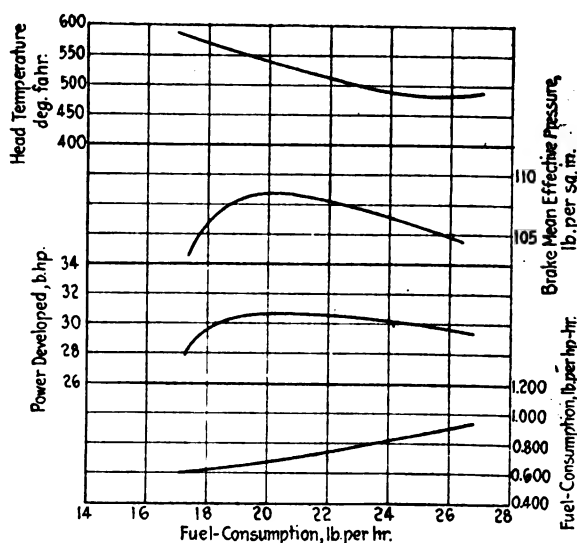


Fig. 2—The effect of fuel consumption upon the output and head temperature of a type D cylinder

soft when hot, but its bad qualities are, nevertheless, fairly well understood as a result of considerable experience. It sand casts relatively well: the tin content, which reduces the strength and hardness, also seems to reduce shrinkage and pin holing.

For cast aluminum cylinders a fin having a length of from 1 to $1\frac{1}{8}$ in., a thickness at the roof of $\frac{1}{8}$ in., a thickness at the tip of $\frac{1}{16}$ in. and a $\frac{3}{8}$ in. pitch is fairly readily cast and is reasonably strong for handling. Fins of a somewhat decreased thickness and pitch can be cast, but are likely to lead to foundry difficulties and are easily damaged.

Use of Cast Iron

Cast iron at present is somewhat despised as a cylinder material. Nevertheless, it can be seen from the B. S. A. and R. A. E. 4D cylinders mentioned earlier in the paper that efficient results are obtainable with this material. I believe that for commercial purposes, excepting aircraft engines, the use of any other material than cast iron for cylinder construction is not justified by the increased efficiency obtained. The use of any more expensive material than cast iron also involves more complicated and expensive construction. In the light of present experience that statement appears to hold good up to an output of 12 hp. per cylinder at about 2500 r.p.m.

Copper has been used extensively for air-cooled cylinders and was employed on some of the earliest air-cooled cars.

The high conductivity is of considerable advantage, but there are many practical objections to its use. One of these is that it is exceedingly difficult to fin a cylinder head efficiently with sheet copper fins. To attach the latter to a spherical head such as the type J cylinder is almost out of the question and in any case entails the use of a heavy iron casting for the body of the head. Some copper air-cooled aircraft engine cylinders were produced in Great Britain during the war. These had a closed end steel barrel fitted with sheet copper circumferential fins, head cooling being attempted by a finned cast aluminum cap. The performance compared unfavorably with that of the composite aluminum and steel type with cast on or screwed in heads. The economical use on a weight basis of copper as a fin material requires the use of thin sheet, and such fins are readily bent and damaged. The copper finned cylinders previously referred to presented an extremely ragged appearance after a short period in service, as handling was sufficient to bend the fins.

Valve Design

Neither the L nor the T-head cylinder is worthy of much notice at this date. In my opinion a good side valve cylinder, for either aircraft or automobile use, is decidedly superior to a crude overhead valve design. In spite of years of effort the number of really efficient air-cooled side valve cylinder designs in existence is probably under a dozen. Such efficient designs as exist are the result of protracted experiment: an overhead valve design to give equal or superior results can be produced readily with practically no development.

The side valve cylinder has marked advantages in comparison with the overhead type. Combustion chamber areas are relatively greater, equally efficient finning cannot be obtained, the temperature distribution is perforce much more uneven and distortion is much more likely to occur. Distortion is exceedingly difficult to avoid in side valve cylinders. The inlet and exhaust ports usually distort the barrel, with the result that piston contact is poor and the ring fit uneven. The valve seats rarely remain true when hot, with the result that grinding in the valves with the cylinder hot is resorted to at times.

The side valve design of necessity departs from the symmetry so desirable for an air-cooled cylinder. For equal class of design and development, the mean effective pressure of a side valve cylinder is usually 20 per cent less than that obtainable from an overhead valve type with continuous full throttle operation. A comparison of cylinders of equal size which is contained in the Internal-Combustion Engine Subcommittee of the British Advisory Committee for Aeronautics Report No. 24 gives, in my opinion, an average figure for the relative efficiencies of overhead and side valve types.

The two-cycle air-cooled cylinder is generally considered to be, almost of necessity, prone to overheating and some consideration of the type is therefore justified. It is not surprising that the average two-cycle air-cooled cylinder should overheat, as it is usually a very light, thin and poorly finned cast iron type. However, efficiently cooled cylinders for two-cycle engines are now produced.

The use of aluminum perhaps is justified commercially for two-cycle cylinders for air-cooled motorcycle engines, for the cooling conditions on such engines are usually very arduous. With cast iron combustion chamber the carbon deposit is both more adherent and of greater quantity than with one of aluminum.

Valve Seat Inserts

Valve seat inserts are a frequent source of trouble in aluminum cylinder construction. Conditions require an insert that has a tight fit and good thermal contact with

the cylinder head metal when both are hot. The use of cast iron or steel inserts is not good practice, regardless of how they are fitted, as the coefficients of expansion of cast iron and steel are only 30 and 40 per cent respectively of that of aluminum. Cast iron or steel inserts if cast in are very liable to cause blowing of the aluminum surrounding the insert. Aluminum bronze has, on the whole, proved the most successful for cast in seat inserts.

Cast in inserts are a poor production proposition in the foundry. They are exceedingly liable to shift on the core when in the mold and cause the bore of the insert to be eccentric with the outside when finish machined. The cast-in insert of any material is prone to develop defective thermal contact or even to come loose. Due to casting shrinkage the insert initially may be tight in the cylinder head when both the head and the insert are hot. As a result either of annealing in the course of production or of the gradual annealing that occurs in operation the casting shrinkage is ultimately largely removed. The less the difference is in the coefficient of expansion of the material of the head and the insert, the greater will be the chance of a cast-in insert remaining tight. Aluminum bronze cast-in inserts have on this account proved markedly superior to steel or cast iron. Cast-in inserts are an example of evading a design issue at the expense of the foundry.

In general, exhaust valve cooling has two distinct phases, cooling through the seat and cooling via the stem and the guide. If either be at fault, inspection when running on open exhaust will determine which is the offender. For efficient seat cooling as effected by valve design, I prefer a tulip valve with a thick rim, possessing greater circumferential conductivity than the flat head valve, and the use of a wide valve seat. The width of the valve seat undoubtedly has a marked effect upon the heat flow from the valve to the cylinder head, as the intensity of the heat flow will depend on the area of the valve in contact with the cylinder. The heat flow from the valve to the cylinder will be affected to some extent by the load of the valve spring: from this standpoint the greater the load the better.

Efficient stem cooling is assisted by extending the valve guide and guide boss down as close to the head of the valve as possible, and shrouding the guide with a heavy boss that is able to conduct away the heat abstracted from both the valve stem and the exhaust gas. The cooling via the valve stem is partly controlled by the sectional area of the stem and the area of the stem in contact with the guide.

Valve Cooling

Claims that the exhaust valve cooling of air-cooled engines is as good as that of water-cooled engines may appear to be an exaggeration. Nevertheless, such claims are not merely my personal opinion, but can be confirmed readily by the Engineering Division of the Air Service.

For an air-cooled engine the results appear to indicate that:

1—The exhaust and the inlet valves should be of approximately equal diameter and have equal lifts.

2—A mean gas-velocity through the valve annulus of from 140 to 160 ft. per sec. seems to give the maximum performance with valves of between $1\frac{3}{8}$ and $1\frac{5}{8}$ in. diameter.

The first conclusion has exceptions, as in large two valve cylinders the exhaust valve is often made smaller than the inlet for valve cooling reasons with satisfactory results. Such an arrangement usually requires an excessive exhaust opening period to produce the best results, in spite of running generally at a somewhat lower speed than the four-valve type.

Experience tends to show that with an increase of the valve size the velocity through the annulus can be increased considerably without affecting the brake mean effective pressure. This is probably due to the decrease in friction in the port, owing to the increase of the ratio between the port area and the maximum area in the annulus.

In reply to an invitation to discuss this paper, Thomas Midgley, engineer of the Fuel Section of the General Motors Research Corp., stated that his experience had been more largely with cylinders of smaller diameter than those discussed in Mr. Heron's paper. He expressed the opinion, however, that the general principles, as outlined by Mr. Heron, would no doubt apply. Lester S. Keilholtz, chief engineer of the Delco Light Co., also stated that his experience had been with engines running about 6 hp. per cylinder and consequently he was not in a position to discuss the larger cylinders referred to.

J. H. Hunt, research engineer of the Dayton Engineering Laboratories Co., expressed the opinion that it would have been a good thing if everyone had experimented with air curves showing the cylinder temperature secured with different mixture ratios. This, he says, was true regardless of whether the engine experimented with were water-cooled or air-cooled. He stated that in experimental work,

if the radiator temperature after a change of mixture were noted, we would know more about engines than we do by simply trying to keep the temperature constant by connecting with city water sources.

H. M. Crane stated that this paper is a challenge to everyone who is designing water-cooled engines. He stated that the paper is of value to the designer, as it shows where high temperatures occur, and this is equally essential whether water or air cooling is used. He dwelt to some extent on the advantages of water cooling, one of the advantages mentioned being that the air-cooled engine delivers the heat to the atmosphere directly from the cylinder, whereas the water leads it away and dissipates it at a point remote from the cylinder itself. He stated that in aviation cooling in the slip stream is a disadvantage, as it is apt to be a factor in head resistance beside resulting in construction which cuts off the pilot's view.

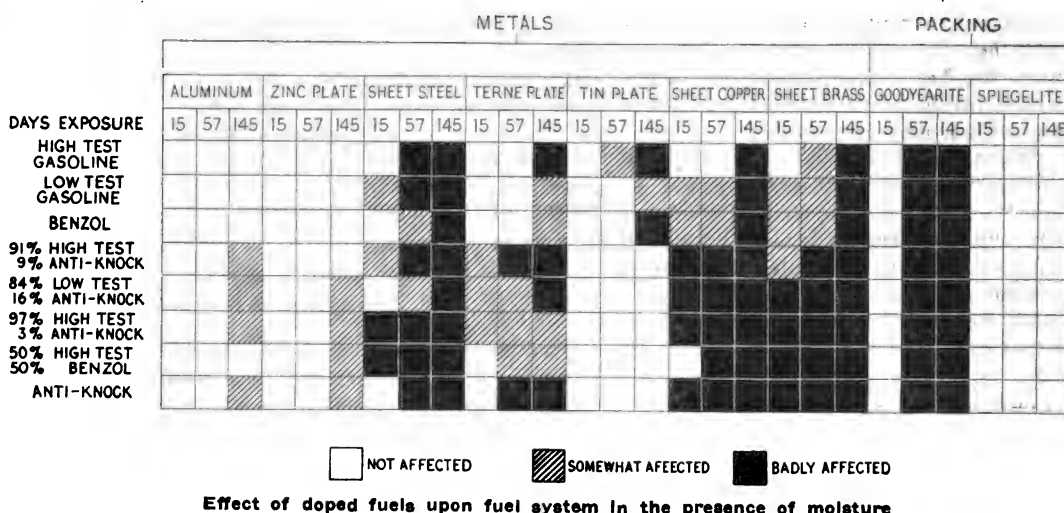
Considerable discussion developed around the advantages of the air-cooled cylinder in extremely cold countries as well as in desert areas where water is hard to obtain. The consensus of opinion seemed to be that for this type of service, the air-cooled cylinder had already proved itself to be highly satisfactory. The use of air-cooled radial engines by the British in the Mesopotamia countries was cited as an example of this.

Effect of Doped Fuels on the Fuel System

THE use of anti-knock compounds in aircraft operation has become practically a necessity, and for two main reasons, viz., the constantly increasing use of higher compression ratios and the necessity for the use of a cheaper fuel. The Material Section of the Engineering Division, War Department, Air Service, McCook Field, Dayton, Ohio, has made an investigation of the effect of these doped fuels on the fuel system. According to the reports issued it was found that

corrosion of the fuel tanks and the subsequent accumulation in tubes and strainers of the corroded matter, due to the use of anti-knock compound, caused obstructions of the gasoline line. Aluminum and zinc are very slightly affected, if at all, by the doped fuels, but copper, brass, terne plate and iron are badly affected. In making the experiments, the following fuels were used:

High-test gasoline, low-test gasoline, anti-knock compound, 91 per cent high-test gasoline containing 9 per cent anti-knock, 97 per cent high-test gasoline containing 3 per cent anti-knock, 50 per cent high-test gasoline containing 50 per cent benzol and 84 per cent low-test gasoline containing 16 per cent anti-knock. The anti-knock compound referred to is anti-knock No. 1, and was obtained from the General Motors Corp. Research Laboratory. This anti-knock compound is said to be composed of 70 per cent aromatic amines and 30 per cent benzol. The amines are probably orthotoluidine, paratoluidine, xylidine, aniline or mixture of these. A diagram of the results of the investigation is given herewith. It may be observed that the metal which stood up better than any other is aluminum. Next comes zinc and third tin, while steel, terne plate and



particularly copper and the copper alloy, brass, are very badly affected by fuels containing anti-knock compounds. The presence of moisture materially increases the effect of these compounds on the metal.

Manufacture of Cast Segmental Wheels

THE Van Wheel Corporation, whose sectional wheel was recently described in these columns, states that, while the manufacture and assembly of the segmental sections, of course, requires certain operations of machining and locking the joints not required in one piece wheels, there are, on the other hand, several operations eliminated in this type of construction which are necessary in a one-piece cast metal wheel. These include: grinding the sides of the wheel, chipping the heavy flash which appears in the one piece castings and not in the segmental section castings, and turning off the excess metal required when pouring a one piece casting.

It is claimed also that the need for truing up is less in the segmental wheel. Beyond this the advantages of lower weight and less material are claimed.

Seamless Steel Tubing in Motorcycle Construction

The tapering of a steel tube in diameter or gage often reduces its weight and increases its strength. In this article the author emphasizes the need of using suitable quality steel and shows a very simple method by which the carbon content of steel can be determined to within 0.025 per cent.

By W. W. Hackett*

S EAMLESS steel tubing is a product of modern times, some fifty years having elapsed since it was first produced commercially. Its use has made possible the manufacture of articles which could not otherwise have been made, while it has also been the means of popularizing the use of articles which, before the introduction of steel tubing into their manufacture, found only a small sale.

From past experiments and errors we gain knowledge of what is practicable and learn what to avoid in the use of steel tubing in cycle and motorcycle construction. It will be useful to review some of the difficulties with which we have had to contend, and to discuss the remedies for failures we have experienced, in order that similar faults, which might be repeated from lack of knowledge of cause and effect, may be avoided.

When the Bowden brake was first used on cycles and motorcycles, numerous breakages occurred at the point where the hole was drilled through the handlebar near the lug in order to allow the cable to pass through. This defect was remedied by passing the cables through a properly designed lug, or through a hole in the lug, but many accidents occurred before the cause of the breakage was discovered and the remedy adopted. Under an alter-

nating stress a tube that has been drilled, unless properly reinforced, is very likely to fail. For the purpose of proving the weakening effect of a hole, in a tube, quite a large number of running tests on drilled and undrilled tubes were carried out on the special machine shown in Fig. 1, and in some cases the undrilled tube had from ten to twenty times the life of the drilled one.

Having found that, when the tube was subjected to a fiber stress of 20 tons, the drilling of a hole reduced the number of revolutions while under alternating stress to one-tenth, or even to one-twenty-fourth, it was discovered that if the area of metal removed is replaced by two $1\frac{1}{4} \times \frac{5}{8}$ in. oval patches merely sweated on each side of the tube around the hole, from 70 to 80 per cent of the life of the tube is restored. Continuing along these lines, two half-bushes, about $2\frac{1}{2}$ diameters long, were sweated to the sides of the tube, whereupon the life of the tube proved to be practically the same as that of the undrilled tube, and instead of a break occurring at the hole, a fracture took place at the chuck of the testing machine.

Tests With Lugs -

Another series of failures was caused by unsuitable lugs. Some of those used in the earlier days of motorcycling had very strong outlets, and case after case of tube failure occurred. The tube often broke off so cleanly as to give the appearance of having been cut through. The broken tube could be flattened, thus proving that it was in a ductile, and not brittle, condition, and a series of tests was carried out in order to prove that the fault lay in the excessive strength of the lug outlets. A lug having strong outlets was taken, and one outlet only being tapered off. A piece of tubing of the usual size and quality was brazed into the lug, the lug then being firmly secured to a plate. The ends of the tube were then moved by eccentrics and connecting rods, giving a half-inch movement at a speed of about 400 r.p.m. Each time the experiment was tried the tube broke off cleanly close to the thick outlet, whereas it was always intact at the tapered outlet.

In another test two tubes brazed into lugs, one with a thick and the other with a tapered outlet, were held rigidly by the lugs and similar weights were applied at the ends. The tube brazed into the lug with a tapered outlet bent with an easy curve, but that brazed into the lug with a strong outlet bent abruptly close to the lug.

Alternating stress tests were also carried out on a number of tubes held in grips, half of which had tapered outlets and the others strong outlets. When the taper grip was used the average number of revolutions before breakage occurred was 248,371, but when the strong outlet was used, breakage occurred after only 120,545 revolutions, or

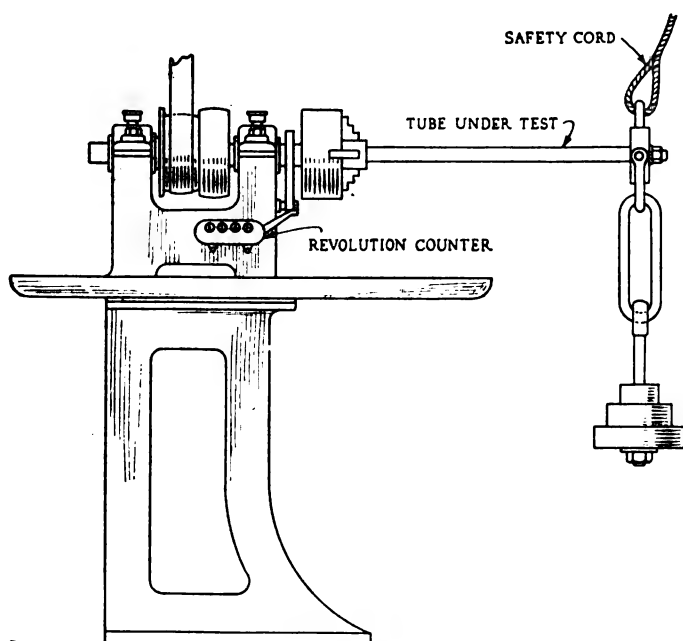


Fig. 1—Alternating stress endurance machine

less than half the number experienced in the case of tapered outlets.

Research work carried out also demonstrated the improved condition of the tube after blueing. The alternating stress tests proved that a longer life could be obtained than was possible in the bright-drawn condition, and blueing, which was specified by the Air Board as heating up to a temperature of between 380 and 450 deg. Cent., was insisted on. There is no doubt that when tubes are to be soldered into position they are better for the blueing, but when they are to be brazed the value of the operation is negated.

It has been proved to the satisfaction of many cycle and

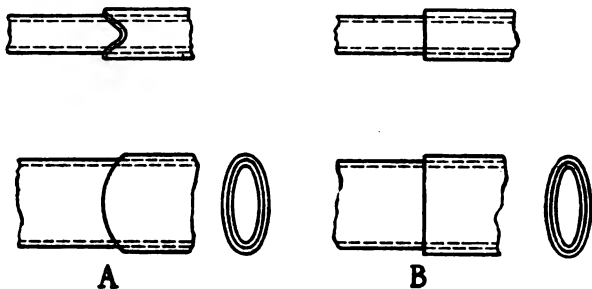


Fig. 2

motorcycle engineers, that to keep on merely increasing the gage of a tube that appears to be too weak for its work is not always good practice. For instance, take the case of the front fork tube as used on the ordinary cycle. This tube has proved of ample strength for use on the highways of this country, but for Continental roads something better was wanted. Some years ago the author's firm supplied a large quantity of front forks produced from 19 gage tubes to Russian cycle manufacturers. We were asked to increase the thickness to 18 gage as a number of breakages had occurred. We did so, but matters were not improved, and we were then requested to further increase the thickness to 17 gage. There was still no improvement; indeed, the number of breakages increased. The forks all broke off where they were brazed into the crown, and we were asked by the Russian manufacturers to help them out of their trouble. One way of doing this would have been by using a suitable liner or sleeve, but we tried another method which proved quite successful. We brought back the gage of the tubes to 18 where brazed into the crowns, and tapered the gage to 22 at the bottom ends. This proved effective, and thus a lighter article by about 40 per cent from the same quality steel stood the strain successfully. The result is accounted for by the fact that the shock was more equally distributed along the tubing, due to the strength being reduced gradually away from the brazed portion, whereas in the plain gage tubing the whole of the movement was concentrated in a very small space near the crowns.

Running Tests on Front Forks

The author has carried out quite a number of running tests on front forks of various tapers, reducing to what may be thought to be ridiculously small diameters at the bottom of the fork, but the life of the fork increased as the size at the bottom diminished. In many cases weight can be saved and increased strength be given by a tapering of the tube in diameter or in the gage.

Alternating tests have been carried out on 1 in. by 20 gage steel tubing, both in parallel lengths and with a taper of $\frac{1}{2}$ in. per foot. A weight of 111.56 lb. was suspended from each tube at a distance of $12\frac{3}{4}$ in. from the grips, giving 25 tons per sq. in. stress. The average number of revolutions borne by the plain pieces was 25,987, while the

tapered pieces, which were $7\frac{1}{2}$ per cent lighter, broke after 30,891 revolutions. In both cases the break in the plain tubes was straighter than in the tapered tubes.

A pair of front-fork tubes, having a D-section at the top portion and tapered to $9/16$ in. round section at the bottom, was brazed into the crown. A weight of $130\frac{1}{2}$ lb., giving 15 tons stress per sq. in. at the crown, was suspended from the tubes, which broke at the crown after 1600 revolutions.

Another pair of forks, of a similar section at the top to those used in the previous experiment, but tapered down to $5/16$ in. diameter at the bottom, was tested in the same way, and broke at the crown after 3180 revolutions. While it will be recognized that this is not an ideal method of testing front forks, it does demonstrate effectively the mechanical advantage gained by reducing the strength away from the breaking point of a tube. Numerous examples from nature's handiwork can be cited to show that this principle is a naturally sound one. In the bones of human beings, animals, fishes, and birds, or in the trunks, branches, and twigs of trees, it is seen that the slow process of evolution has produced the design best suited to withstand the natural forces with which certain embodiments of life have to contend, and that all the parts mentioned have assumed a tapered form.

Value of Taper-gaging

On motorcycle frames it is possible greatly to decrease the weight of the tubes by a proper distribution of the strength. The motorcycle manufacturer knows at which part of the frame breakage occurs. In many instances the front down-tube has been the vital part, and the break has occurred close to the top lug. It is much better to put in a taper-gage tube to prevent the trouble than merely to increase the gage. If a 12 gage down-tube has previously been used, a tube of the same weight, but tapered from 10 to 14 gage in its entire length, will, no doubt, remedy the defect. The tube is stronger because of its added thickness at the critical point, and also because the tapered gage enables the fatigue to be carried away from the lug. A 12 to 15 gage or a 12 to 14 tapered gage would be stronger than the 12 gage plain tube. Another place where breaks have occurred is at the front of the top tube. This weakness can be removed by butting or taper-gaging the tube.

Front forks are a critical point on a motorcycle, and to a great extent determine the shocks the frame has to take. The proper springing of a front fork takes away a good proportion of the shocks from the frame, the springs themselves absorbing the strains. The more the shocks are absorbed by the springs, the less the tubing is fatigued. It is possible to use springs too strong for their work, and



Fig. 3

too great a factor of safety on a spring may mean an increasing strain on the frame. After stronger springs have been put on the forks, the author has seen breakages occur in the steering columns or fork tubes when these parts were previously satisfactory.

The tubes on front forks are always liable to fatigue, and breaks often occur against the lugs. The builders cannot take too much care in the production of these forks, as there is often a thinning of the tube at the point of junction with the lug, caused by filing after brazing. It is much better to leave some trace of brass there than to

take the steel away. The lugs should be kept as light as possible at the outlets, and a lug with a curved shape at the outlet as illustrated in Fig. 2-A is better than one with the square-cut outlet generally used, Fig. 2-B.

Some makers "liner" the fork blade, and this is a very wise procedure, as in the case of fracture of the blade there is a support that may prevent an accident, but the value of a liner in preventing a fracture is very small indeed. In order to lessen the risk of fracture of the tube, the liner may be soldered or brazed to the tube. Should the break occur, however, the liner will probably give way at the same time as the blade. The disadvantage of this practice is that no warning is given, whereas when a loose liner is used the fracture of the outer tube is noticed before a complete break occurs. The blade with a liner



Fig. 4—Re-inforcing tubing

soldered or brazed in has, however, a longer life before a fracture takes place. It is always advisable, if a liner heavier in gage than the tube it is intended to reinforce be used, to taper the gage at the ends of the liner gradually to below that of the outer tube, as in Fig. 3.

The efficacy of a liner depends upon the position of the reinforced tube in the frame of a machine. Take, for example, the reinforced tubing shown in Fig. 4. These sections, where bending or compression strains occur, are most useful, but where the tubes are in tension they are not satisfactory. In the case of the front down-tube of a motorcycle, which has the vibration and weight of the engine to counteract, the strain has to be borne almost entirely by the outer tube. If this fractures, it will draw away from the inner tube, unless the inner and outer tubes have been properly brazed together. Numerous experiments have been carried out which have proved these

points. Alternating stresses were applied to front forks, various lengths and thicknesses of liners being used. The longer the liner, the better the result obtained. The break, however, still occurred at the lug, but the brazing of a piece of steel on to the outside of the blades strengthened them sufficiently to make the steering column break instead of the forks. These tests are illustrated by Fig. 5.

The following tests seem to prove conclusively the added value given by a tight-fitting liner. The only way to ensure a liner being tight is to draw it into position, the liner being expanded against the tube, or the tube being drawn tightly round the liner.

Alternating-stress tests on tubes with tight- and loose-fitting liners

Size of outside tubes.....1 in. by 20 g.
Thickness of liners20 g.

For the tight-fitting liner tests the 1 in. by 20 g. tube was drawn on to the liner and then cut into test lengths. For the loose-fitting liner tests the 1 in. by 20 gage tube was cut into test lengths and the liners were pushed in by hand. The 1 in. by 20 gage outside tube was tested with no liner.

Tests were made on plain tubes held in a loose socket and also on tubes brazed 1 in. into thick lugs. The results of the tests were as follows:

- (1) Tight liner. Stress at socket 20 tons.
Plain tube broke at socket at95,647 revs.
- (2) Loose liner. Stress at socket 20 tons.
Plain tube broke at socket at23,579 revs.
- (3) Tight liner. Stress at lug 20 tons.
Brazed joint broke at lug at2,579 revs.
- (4) Loose liner. Stress at lug 20 tons.
Brazed joint broke at lug at503 revs.
- (5) Tight liner. Stress at lug 15 tons.
Brazed joint broke at lug at9,886 revs.
- (6) Loose liner. Stress at lug 15 tons.
Brazed joint broke at lug at2,746 revs.

In the plain-tube tests the outer tubes and the liners broke, but in the brazed-joint tests the outer tubes only broke.

1 in. by 20 gage outside tube only

- (7) Plain tube. Stress at socket 20 tons.
Broke at socket at12,811 revs.
- (8) Brazed joint. Stress at lug 15 tons.
Broke at lug at2,614 revs.

Besides using means such as tapering, etc., for over-

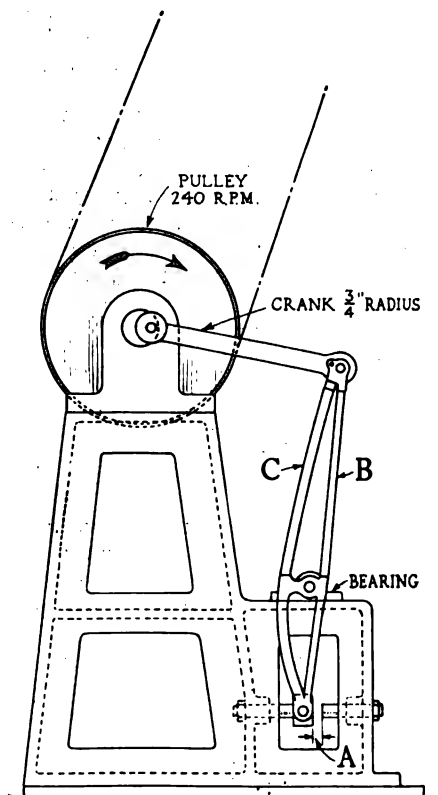


Fig. 5—Testing Machine for motorcycle forks. Dimension "A" is so arranged that the fork under test shall move at this point $\frac{1}{4}$ in. less than the theoretical movement (according to the dimensions of machine parts and fork), this making the fork bend, i.e., tubes "B" and "C" are alternately in tension and compression

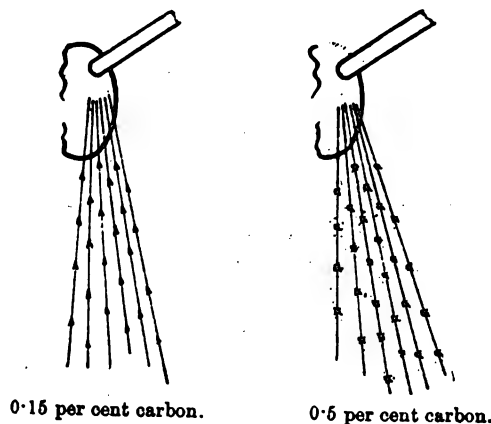


Fig. 6

coming possible weakness, too much care cannot be taken to put into the different members steel of a suitable quality. From experiments carried out during the war period on airplane tubing, it was found that excellent results could be obtained by using 0.5 per cent carbon steel tubing, giving in the bright or blued state a yield of 40 to 45 tons per sq. in. and an ultimate stress of 45 to 50 tons per sq. in. When annealed, the steel should give

23 tons per sq. in. yield and 35 tons per sq. in. ultimate. The author found, however, that in the motor trade there was no inclination to use these high-carbon steel tubes, and opinions were expressed that the tubing from this steel would of necessity be brittle. While it is recommended that care should be taken with the heat-treatment, the whole of the author's testing has been carried out on joints brazed in his shops in a commercial manner, with no more care taken than in ordinary production. Although hundreds of tests have been carried out, he has not had a contradictory result, the value of carbon steels being proved; 0.3 per cent carbon tubing has always been better than 0.15 per cent, and 0.5 per cent always superior to 0.3 per cent.

Sometimes there is uncertainty as to the grade of steel of tubing carried in stock. The tube maker may get some wrong billets from the steel maker, or mistakes may occur in transit or in the tube works. If any test is to be made to check the carbon contents on commercial lines, that test must be a cheap one. The "Spark test" for carbon is a quick method, and, in the hands of a capable

and properly trained man, the percentage of carbon in the steel can be determined to within 0.025 per cent.

When a piece of steel is pressed against a grinding wheel a shower of sparks is produced, and this shower may be called a "spark-sheaf." The spark-sheaf consists of spark rays or lines of light, produced by the flight of the sparks, and spark pictures, which are small explosions appearing along the spark rays. It is chiefly from the spark pictures that the percentage of carbon is estimated, since the brighter and more numerous the spark pictures, the higher the percentage of carbon. For example, in a 0.15 per cent carbon steel the spark pictures are small and few in number, whereas in a 0.5 per cent carbon steel the spark pictures are clustered together much more thickly and are bigger and brighter, as suggested in Fig. 6. Steel can be tested by this method in any condition, since the character of the spark-sheaf is not affected by the physical condition of the steel. It is possible by this method to test each piece by merely touching the grinding wheel with it in such a manner that the tubing is not rendered unserviceable.

A French Development in Tops

AN unusual type of top is one of the features of the automobiles produced by the Voisin Company. This firm having been a pioneer in the aviation movement, has paid a lot of attention to head resistance in the design of its cars, and has condemned the conventional type of top as responsible for a considerable waste of power. Their design cheapens production, reduces weight and improves the streamlining of the car.

On close-coupled four-seater semi-sporting type bodies the top is carried on a couple of steel tube T-members, the forward one of which is dropped into a socket immediately behind the front seats and the rear one in a similar socket back of the rear seats. At the base of the vertical member of the T is a notch which fits over a pin in the socket, thus preventing any tendency to turn. The canvas is entirely separate from the frame. The top and back are in one piece, and when not in use are folded up and kept in a suitable pocket, or under the rear seat cushion. When required as a protection, the canvas is fastened down at the rear by push buttons, carried over the two T-members and brought over the top of the wind screen frame. Attachment is made at the front by a stiffening bar running through the front edge of the canvas, and having its two ends fitting into eyes on the top of the windshield frame.



Details of the new Voisin top

of the stem are wedged in position between the floor and the underside of the deck. The top can be put up or taken down quickly and with little exertion. Construction is cheap, for the frame consists only of steel tubing with plated finish, with one end threaded to take a nut. Weight is certainly 50 per cent less than with an ordinary type top.

French Aviation Appropriations

CIVILIAN aviation in France will receive during 1922 a total of 154,878,000 francs from the French Government, according to the budget estimate for the year which was recently made public. The largest item in the estimate is 84,405,000 francs for works, aerodromes, technical laboratories and meteorological services. Subsidies totaling 37,022,000 francs have been set aside for French companies, enabling them to share in transcontinental transportation. In 1921 the sum for this purpose was 27,885,000 francs.

Six new international air lines are to be established in

France during this year. While it has not been definitely established as to where these lines will run, indications are that Bordeaux will become a port for the head of lines to Switzerland, Morocco, Spain, Italy and the Mediterranean routes, as well as a stop on the Paris-Lisbon (Portugal) route.

There is available in the Automotive Division of the Bureau of Foreign and Domestic Commerce a comprehensive report on "What the French Government is Doing for Commercial Aviation." It may be obtained by applying to the division for exhibit No. 49,220.

The Relation of Carburetion to Fuel Economy

Part I

The solution to the problem of fuel economy centers about that of proper carburetion. Mr. Golten states that existing carbureters and hotspot devices are inefficient and urges study of problem from a new angle.

By J. N. Golten

THE chief problems of the automotive engineering fraternity to-day are those relating to fuel economy.

These problems are many, and they vary from the purely mechanical to the highly theoretical. Such considerations as increasing mechanical efficiency, decreasing gear ratio, etc., offer minor means of increasing car mileage, but the greatest latent possibilities center about the solutions of carburetion problems.

The statement has often been made that the fuel consumptions of our present day engines can and must be reduced, and numerous minor changes in engine design have been made with this end in view, most of them centering about the carbureting system. However, nothing really drastic has been undertaken, probably because there has not been sufficient co-ordinated knowledge of the essentials of proper carburetion.

The exposition that follows is intended to be a summing up of the conditions necessary to proper carburetion, in a modern engine, with modern fuels, and statements on the shortcomings of the carbureting means now ordinarily employed. It is the purpose of this article to present for the first time these various facts in their true relation to each other and the carburetion problem as a whole.

Functions of a Carbureting System

The ultimate aim of the carbureting system is to introduce into all the cylinders of an engine equal amounts of the most economically burning mixture. With this object in mind the three primary essentials of a correct carbureting system may be stated thus:

- 1—The metering of the most economical air-fuel mixture at all loads and speeds.
- 2—The uniform distribution of this mixture to all the cylinders.
- 3—The complete vaporization of all the fuel at the instant the spark passes in the cylinders.

These three essentials will be taken up in the order stated.

From time to time excellent articles have been published, tabulating the results of exhaustive tests made to determine the most economical mixture ratio for various speeds and loads,¹ but in spite of this fact the general knowledge of proper mixture proportioning for maximum economy is exceedingly hazy.

There is a widespread impression that a constant air-fuel mixture ratio of 15 or 16 is the most economical at all speeds and loads, but this idea is erroneous. Actually,

at any given speed the mixture ratio for maximum economy varies from about 12 at no-load to about 17 at full-load. (These figures are for gasoline.)

Following are a few curves taken from P. S. Tice's article on "Carburetion Requirements of a Typical Gas Engine" which may serve to make these points somewhat clearer.

These curves represent the variation of the brake specific consumption in pounds of fuel per brake horsepower hour, with variation in the air-fuel mixture proportion, (R), for several manifold pressures. A line drawn through the lowest points in each curve will give the variation in the mixture ratio of maximum economy with change in manifold pressure. This relation is represented by curve AB , Fig. 2, where R is plotted against absolute pressure in the manifold (H_a). The relationship shown by this curve is practically independent of speed. It is solely a function of the absolute pressure existing in the intake manifold.

It will be noticed that at an absolute manifold pressure of 300 mm. of mercury, which corresponds to a car speed of from 15 to 18 m.p.h., a very small change on either side of the air-fuel ratio (R) corresponding to maximum economy results in a very large increase in the fuel consumption. As the manifold pressure increases a given variation in R accounts for a much smaller variation in fuel consumption. It is rather unfortunate that at manifold pressures which correspond to the normal running speeds of a car, comparatively small deviations from the most economical mixture ratio account for such large increases in the specific fuel consumption.

Metering Characteristics of an Ideal Carbureter

The ideal metering characteristics for a carbureter would be one in which R would vary with the manifold pressure according to the relationship shown in Fig. 2, curve AB , until nearly maximum manifold pressure was reached, and then R would change to the mixture ratio giving maximum power. As long as an increment of manifold pressure, meaning an increment of throttle opening, accounts for an increase in power, it is highly desirable to have the carbureter set so as to give maximum economy, but full throttle opening is only occasioned by a demand for maximum power, and this demand can only be satisfied by a reduction in R so as to get maximum engine output. Such a metering characteristic is shown in curve AC , Fig. 2.

Repeated tests with gasoline as fuel have shown that a mixture-ratio of 12 to 13 will give maximum power independent of speed or load. Curve DC , Fig. 2, which is a

¹ See P. S. Tice's article, "Carburetion Requirements of a Typical Gas Engine" in *Automotive Industries* of June 24, 1920, and "The Carburetion of Gasoline," *Purdue Engineering Experiment Station Bulletin No. 5*, by O. C. Berry and C. S. Kegerreis.

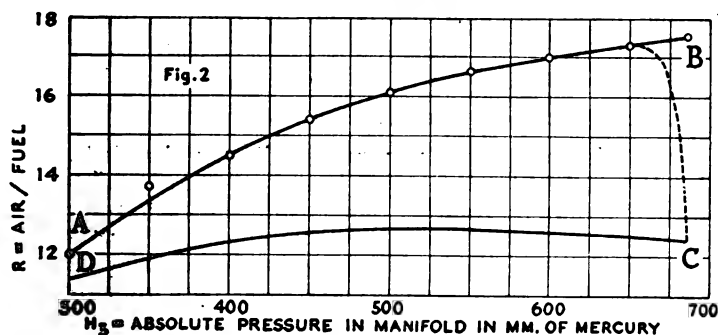
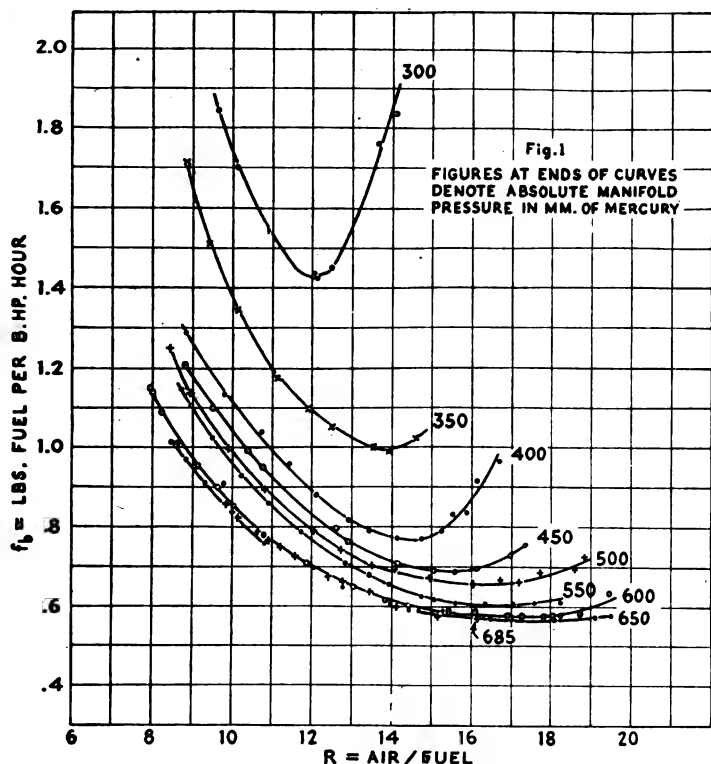
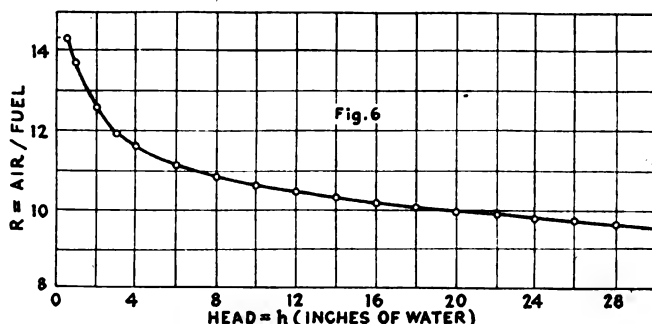
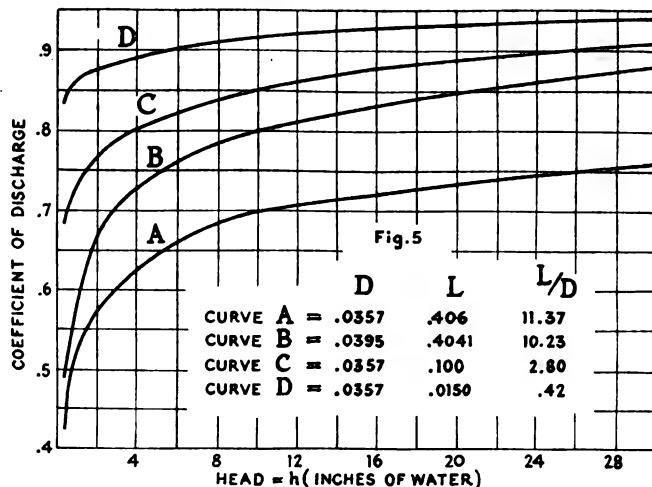
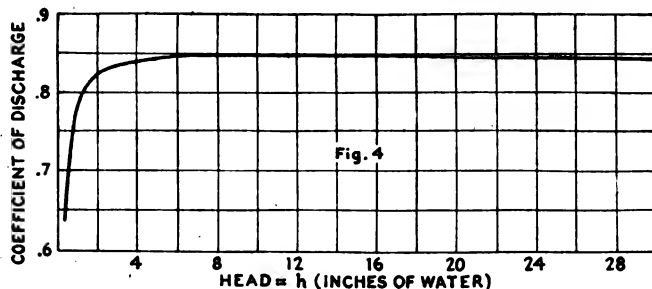


Fig. 1—Variation in specific fuel consumption with change in the mixture ratio, for various manifold pressures. Fig. 2—AB, curve of most economical mixture ratio with relation to engine load as represented by manifold pressure. AC, metering characteristic of an ideal carburetor. DC, mixture ratio of maximum power relative to engine load. Fig. 3—Variation in the coefficient of discharge of a typical carburetor venturi throat, with change in metering head. Fig. 4—Coefficients of discharge of carburetor metering orifices relative to pressure drop across these orifices. A comparison of curves A and B shows the effect of a change in orifice diameter upon the value of the coefficient of discharge. A comparison of curves A, C and D shows the effect of a change in orifice length upon the value of the coefficient of discharge, and its rate of variation with change in head. Fig. 5—Metering characteristic of a simple carburetor incorporating a throat having a characteristic similar to the one shown in Fig. 4, and a metering orifice with a characteristic similar to curve B, Fig. 5.



typical curve, illustrates this. It is plotted from the same data as other curves of Figs. 1 and 2.

It is often stated that present-day carburetors are almost perfect as metering devices, but actually the reverse is true. This statement may sound radical, but by analyzing the performance of a simple carburetor and then proceeding by steps to the present-day carburetor we may show in what respects the latter are faulty. Fig. 3 is a representation of such a structure. X is a constant level source of fuel supply for the nozzle Y which operates in the venturi throat Z. W is an adjusting needle used to vary the effective nozzle opening.

The force or metering head which causes fuel to be discharged at Y is expressed by the formula $Kh = \frac{V^2}{2g}$

in which K is equal to the ratio of the density of the air passing through the throat to the density of the fuel $\left(\frac{d_a}{d_f}\right)$; h is included so that the metering head, or force

²The coefficient of discharge is the ratio of the effective area of an orifice to the actual area. Due to contraction of the stream flowing through an orifice, the effective area is always less than the actual area.

which causes the fuel to flow can be expressed in inches of fuel; V = the velocity of the air through the throat; and g = acceleration of gravity = 32.2. The weight of fuel, f, discharged from the nozzle, Y, in unit time is expressed by the formula

$$f = ca \sqrt{2gh} d_f$$

However,

$$h = \frac{V^2}{2gK}$$

Substituting for h

$$f = \frac{ca d_f V}{\sqrt{K}}$$

in which c is the coefficient of discharge² of the nozzle jet; a is the area of the nozzle jet; and d_f = density of fuel; the other symbols having the same significance as in the previous expression.

For a given amount of air flowing through the throat in unit time f may be varied either by changing the size of the throat, and thus changing the velocity and metering head, or by changing a, the area of the nozzle. The latter means of adjustment is the ordinary one.

The weight of air, A , flowing through the throat in unit time is expressed by the formula

$$A = C a_1 V d_a$$

in which C is the coefficient of discharge of the throat; a_1 = throat area; V = velocity of the air and d_a its density.

The mixture-ratio R of such a nozzle and throat = A/f

$$R = \frac{A}{f} = \frac{C a_1 V d_a \sqrt{K}}{c a_f V} = \frac{C a_1}{c a_f} \left(\frac{d_a}{d_f} \right)^{1.5}$$

From this expression it will be seen that if the areas a_1 and a_f and the densities, d_a and d_f , are constant, the mixture-ratio R will be a direct function of the ratio of the coefficients of discharge C/c .

With the shapes of venturis ordinarily employed, the coefficient of discharge, C , varies only between very narrow limits. (See Fig. 4.)

However, the same cannot be said of the coefficient of discharge of the fuel orifice, c , which may vary between very wide limits, its value depending upon h , the pressure drop across it. The rate of variation of c with h depends

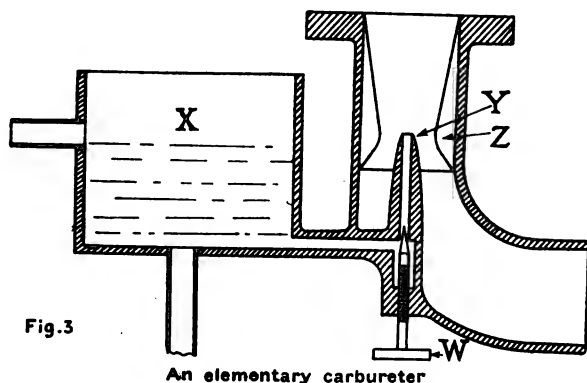


Fig. 3

An elementary carburetor

upon the ratio of the orifice length to its diameter. Several typical curves illustrating this are shown in Fig. 5.

It will be noted that the coefficient of discharge for an orifice in a thin plate is very nearly constant. (Curve D.) With such a metering orifice in a carburetor, R would remain almost constant. However, in all carburetors work the fuel metering orifices employed are relatively long compared to their diameters, and this results in a metering characteristic in which R becomes smaller and smaller as A increases, when exactly the opposite effect is needed. Fig. 6 is a curve showing the variation in R with change in h , for a venturi with a constant C , and a fuel orifice with a coefficient varying according to curve B, Fig. 5.

There are other contributing factors which cause the mixture to become richer with an increase in A or h . In order to prevent dripping from the fuel nozzle when the carburetor is not in use, the fuel level in the float chamber must be maintained below the top of the nozzle. Thus a portion of the actual metering head, h , is employed in merely lifting the fuel and does not cause any flow. As A , and consequently h , is increased, the ratio of effective metering head to actual metering head is increased, resulting in the mixture becoming slightly richer.

Pulsating Air Flow

A very much more important factor and one of which very little is generally known is the increase of effective metering head due to pulsating air flow through the venturi throat. No matter what the direction of the air flow through the venturi, the throat pressure is always less than the pressure at either the upstream or downstream end, and consequently there will always be an effective metering head, causing fuel to flow independent of the direction of air flow through the throat.

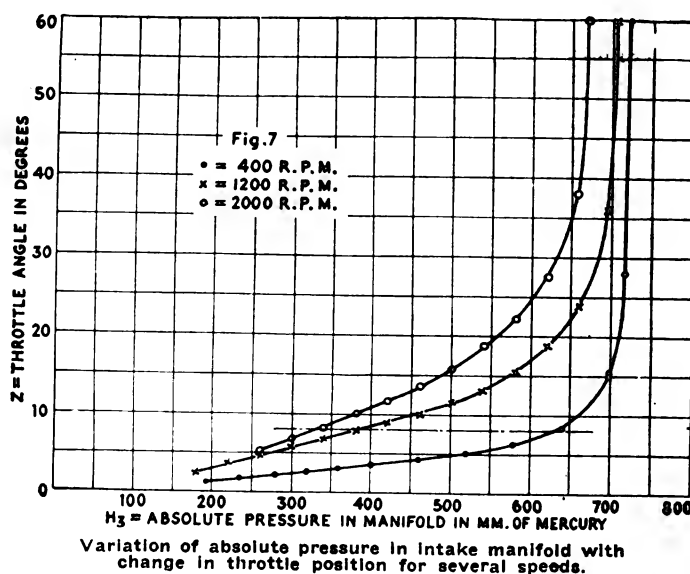
In order to visualize the effect of pulsating air flow upon the air-fuel mixture-ratio let us assume an extreme case in which the same fixed volume of air is alternately forced back and forth through a carburetor throat. With this happening there will be fuel discharged from the nozzle, in amount depending upon the rapidity of the pulsations, but there will be no actual air pumped. For such a condition R would be infinitely small. In actual practice this exaggerated effect does not take place, but there is an appreciable pulsating flow through the carburetor throat which contributes to the normal metering head.

Anyone who has held his hand in front of the carburetor inlet of a four-cylinder engine operating at wide-open throttle will vouch for the fact that there is quite an appreciable "blow-back." In some cases a fine plume of fuel spray can be seen issuing several inches from the carburetor mouth. This blow-back varies with the speed, its variation depending on the number of cylinders, the engine valve timing and the amount of throttle opening. The effect of the blow-back is inappreciable at small throttle openings, but at open throttle it may increase the metering head by as much as 65 per cent.* It is largely because of this variation in pulsating flow that a carburetor which works satisfactorily on one engine may be found to be entirely unsuitable for another of the same displacement.

In addition to these effects, bosses placed near the carburetor throat and the shape of the passages leading to the throat, produce effects on the effective metering head due to the throat, which are changeable and very difficult of explanation.

Carburetor Problems and Design

From the preceding paragraphs it may be deduced that the carburetor engineers have some hard problems on their hands in order to compensate the carburetor so as to give usable mixture ratios throughout the throttling range, and the methods they have employed in attempting to solve these problems have been both numerous,



Variation of absolute pressure in intake manifold with change in throttle position for several speeds.

and from the standpoint of maximum economy, ineffective.

Some small idea of the amount of work that has been done in order to develop a successful carburetor may be gathered from the comprehensive report on carburetors and carburetor patents written by Lucke,⁴ in which he lists and classifies over 3400 different carburetors patented in the United States.

The means employed by these designers to secure

* This figure has been obtained by experiment on a 4.0 x 5.25-in. 4-cylinder truck engine.

⁴ Second annual report of the N. A. C. A., 1916.

what they considered proper metering characteristics are both numerous and ingenious, but practically all of them have striven after the wrong goal. True, a few have met with some measure of commercial success, as witnessed by the carbureters on the market to-day, but they have all fallen far short of the ideal.

The auxiliary means employed to vary the mixture proportions on the better known carbureters of to-day consist of multiple nozzles, auxiliary air passages, cam operated needle valves, weighted valves, "air bleeds," etc., or combinations of these, but without exception the carbureters are so designed that the variations in mixture proportions depend upon the throttle position, or the quantity of air pumped by the engine, or both, whereas, as we have seen before, variation in R should be solely dependent on the absolute pressure existing in the manifold.

Figs. 7, 8 and 9 are curves showing the relationships existing between throttle angle, Z , air pumped by the engine, A , and the manifold pressure, H_s . An examination of these curves in connection with Fig. 2, in which is shown the variation in the mixture ratio of maximum economy with manifold pressure, will serve to explain the shortcomings just referred to.

Following is an example of the errors in metering relationship introduced in a carbureter giving a constant R , or one in which compensation is attempted by any of the just named means. Let us assume a fixed throttle opening of 8 deg. Referring to Fig. 7, we find that at the several speeds shown H_s is equal to .332, .385 and .630. Taking these values and referring to Fig. 2, we find that these several manifold pressures correspond to mixture ratios of 12.83, 14.19 and 17.20.

Thus, for these several speeds we find that for the best results we need widely different air-fuel ratios, whereas the conventional carbureter is designed to give but one. Therefore, at only one of an infinite number of speeds will the mixture from this carbureter be correctly proportioned at that particular throttle opening. The same reasoning holds true for all other throttle positions.

For those carbureters that depend upon the amount of air flowing for any extra variation in the metering head or fuel nozzle opening, there is a similar error. If we assume a fixed quantity of air and determine the corresponding manifold pressures and mixture ratios for the several speeds, there results a similar large range of mixture ratios, which indicates a corresponding error. Thus it may be positively stated that any and all carbureters that depend upon a change in air or throttle opening for a change in mixture proportions, can never

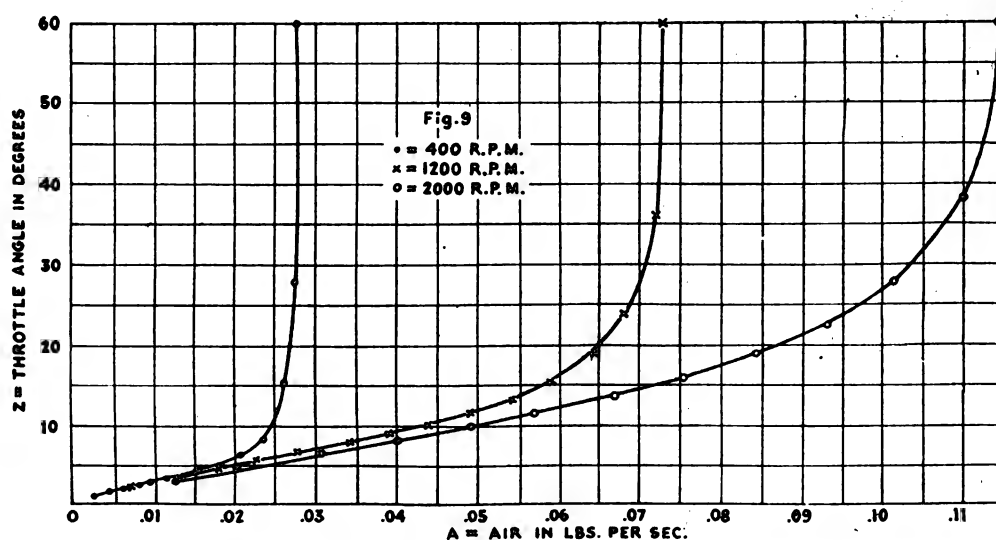
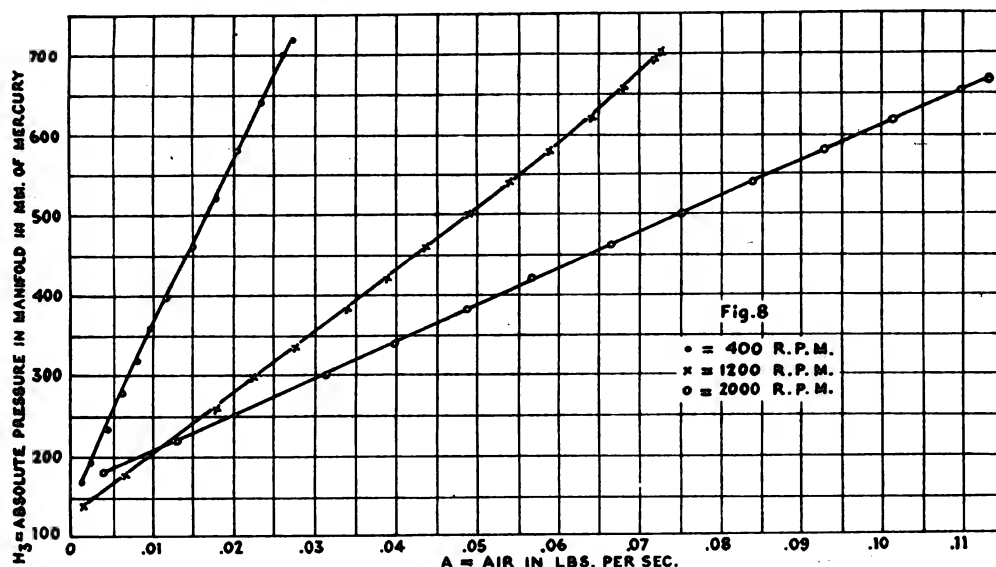


Fig. 8—Relation between absolute pressure in intake manifold and quantity of air pumped for several speeds

Fig. 9—Relation between throttle angle and amount of air pumped at several speeds

be made to realize the mixture proportions of maximum economy at all loads and speeds, or even closely approximate these ratios.

Proper mixture proportioning is of absolutely no avail unless we have at the same time perfect distribution. The mixture ratios giving maximum economy are fairly close to the lean limits of combustibility; consequently, should one of the cylinders receive less than its share of the fuel the mixture in that cylinder will be so lean that it will either fail to ignite or burn so slowly as to provide very little power. In either case the result will be a ragged running engine. In order to avoid this condition of uneven running, the operator enriches the mixture so as to get the lean cylinder to fire regularly, and in so doing he provides an excess of fuel to the remaining cylinders with a resulting loss in economy. This catering to a lean cylinder or cylinders is experienced in almost all engines.

All that has been said in the foregoing paragraphs on metering has implied the condition of perfect distribution, but, sad to relate, with our present carbureting systems and modern fuels, this condition is never obtained because of the presence of liquid fuel in the inlet manifold.

(To be continued.)

Quantity Production of Passenger Car Axles

A description of methods followed in the manufacture of axle housings at a plant built especially for this purpose by the General Motors Co. Output is nearly three times as great as that formerly possible with the same number of men and same floor space, due to special tool equipment.

By J. Edward Schipper

A NUMBER of the axles for General Motors cars, including Oldsmobile, Oakland and others, are being made in the new axle plant which adjoins the Oldsmobile factory at Lansing, Mich. This building was designed and built especially for this purpose. It measures 140 x 750 ft., giving a total floor area of 105,000 sq. ft. The entire building has been designed to put through the axles rapidly in a progressive manner so that the flow of material is constantly in one direction from the point at which it enters as raw stock to that at which it leaves as completed axles. Both front and rear axles are made in this building.

Arrangements have been provided in the way of traveling cranes with electric magnets for unloading the incoming stock and loading the outgoing axles. The equipment at the present time consists of sufficient machinery to manufacture 400 front and 400 rear axles per day. The building is so designed that it allows latitude for expansion. Additional machinery can be installed to double present capacity. In the manufacture of the rear axles, the majority of the machining work is, of course, required on the housing. The axle tube, axle shaft and other units are relatively simple and can readily be handled by stock machines. However, a great deal of special machine equipment which is very interesting from the standpoint of economy of space, as well as rapidity in manufacture, is used in the production of the axle housing. An idea of the plant layout is given in Fig. 1.

The machine operations not only on the housing, but also on the axle shaft and tubes, takes place at one end of the building and partially along the rear axle assem-

bly line, so that the finished parts are brought to the assembly department at a point where they can be applied to the assembly without requiring intermediate stocking in finish or semi-finish stock rooms. Malleable castings for the housings come in from outside and are in three parts; left and right differential housings and the pinion shaft housing. It will be remembered that the Oldsmobile has a torque tube arrangement on the rear axle, the

pinion housing taking the differential housing at the rear end and the torque tube, which incloses the propeller shaft, at the front end.

Malleable housings for the differential and drive gearcase require different machine operations on the left and right sides owing to slightly different shapes, and the fact that one of them has to be drilled for oil filler and drain holes. These two housings are bell-shaped, the large ends being joined in assembly and the smaller ends being bored to take the tubes which surround the axle shaft.

The left differential housing is almost entirely machined in a remarkable special machine, Figs. 2 and 3, which is the design of the Defiance Machine Works. It is a two-way automatic, which performs a complete series of operations. The work is located on a floating sleeve with three floating pins which butt against the work in the center, and another floating pin which passes between the bosses for the brake camshaft holes. The work is fixed in position by a floating center clamp and is driven by two set-screws. The machine is capable of 45 pieces per hr., but owing to the fact that hard castings have been encountered recently, the speed has been cut down to 33 per hr.

There are ten operations altogether on this machine,



Fig. 1—Portion of Oldsmobile axle shop, showing part of the assembly line in the foreground

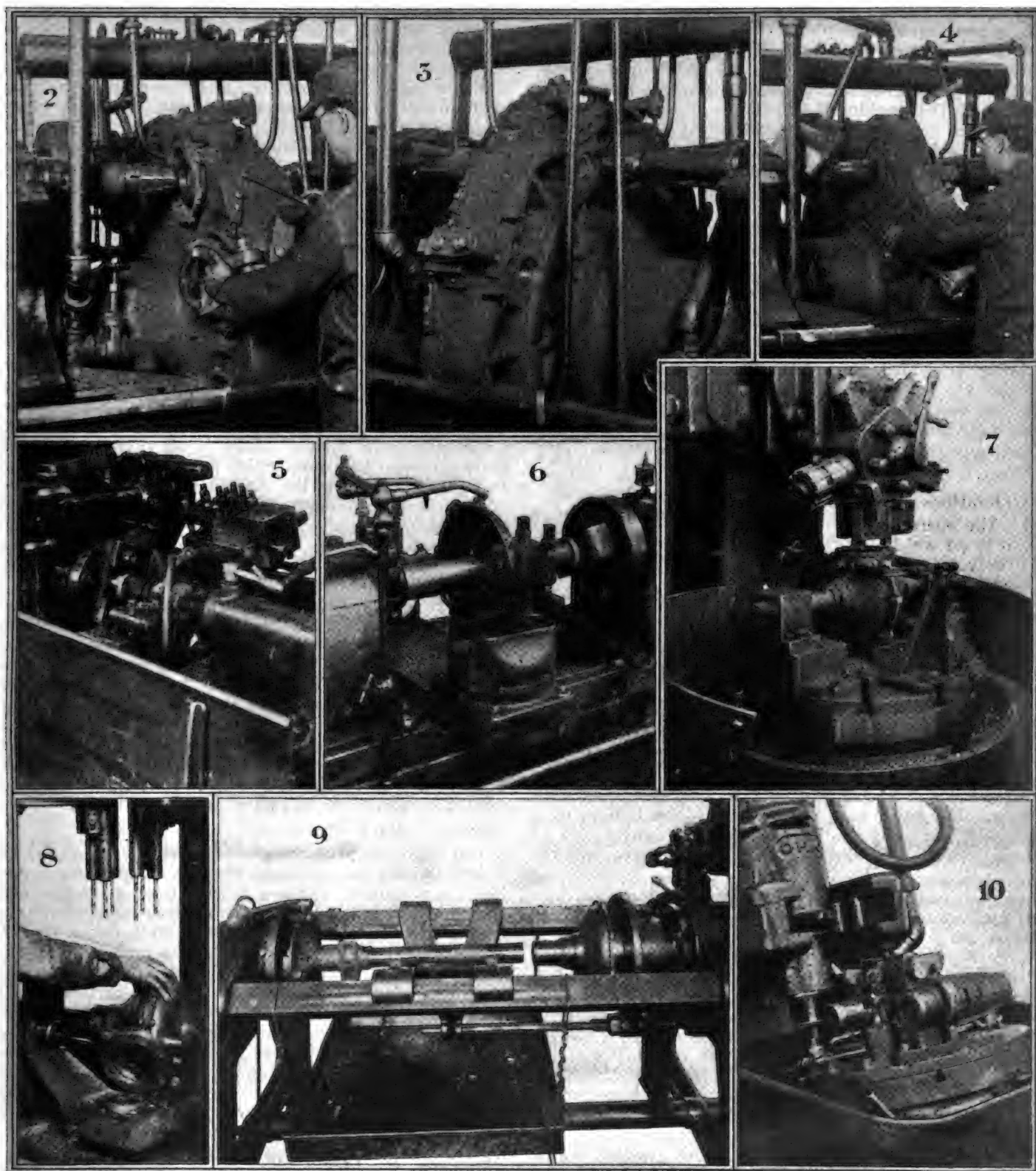


Fig. 2—Operations on the malleable differential and drive gear housing on the Defiance special, two-way automatic. This illustration gives an idea of the chucking and location of the work, as well as the way in which the three internal diameters are handled simultaneously on the left side of the machine. Fig. 3—Operations on the rear axle center housing on the right side of the Defiance two-way special automatic. The operations on the right and left sides of the machine are carried on simultaneously. Fig. 4—Defiance two-way special automatic used for the pinion shaft housing. This is a similar machine to that used for the central housing. Fig. 5—Roughing flange joints at the center of the rear axle housing on Fay automatic. Fig. 6—The finish work on the flange joint is done on LeBlond heavy duty lathes, of which there are two. Fig. 7—Finishing the outside of the housing on a semi-automatic Gisholt boring mill. These machines perform six operations at a speed of 1000 pieces per 9 hr. day. Fig. 8—interesting jig method for locating the work on the Gardam multiple spindle drill for the six $\frac{3}{8}$ in. stud holes in the flange of pinion shaft housing. Fig. 9—Pressing in the axle tubes on an Eastern air press. Fig. 10—Sawing the bearing clamp slots in the pinion housing on an Ohio tilted rotary miller.

some of which are compound, so that the number really runs up to considerable more than this. The operations are indexed automatically. The first is a rough boring

operation both on the left and right side, the small rougher going into the small end of the housing, Fig. 3, and the large rougher into the bell opening. This opera-

tion also spot-faces the different depths on the interior of the housing, Fig. 2.

The second operation consists of boring a cluster of seven 25/64 in. holes on the open side and semi-roughing, spot-facing and chamfering operations on the small opening also. The machine then revolves to the third operation, which produces a semi-finish on all three bores on the open side and includes a finishing operation on the depths on the open end. At the same time centers are made for the two holes for the brake camshaft and the bosses on the small side.

In the next index position a finish reaming of the open end for all three bores is accomplished. This is done with a sectional reamer which reams three surfaces simultaneously. On the other side, the 5/16 in. holes and the bosses which were centered on the previous operation are drilled.

The next and final operation on this machine is the tapping on the open end of the 33/64 in. bore for a sixteen thread, 1 1/4 in. deep. This is the thread for the adjusting nut which governs the position of the ring gear. On the other side of the machine, simultaneously with this, the tapping of the two 3/8 in. holes in the bosses is taking place.

Operations on Right Housing

The operations on the right housing are very similar to those which have been described on the left housing. The machine used is also similar, being one of the Defiance two-way automatic lathes which was designed specially for the General Motors Co. and with their co-operation for this work. The location is from a floating sleeve and the work is held in place by a floating chuck clamp as in the other case. The drive is through two set screws which hold the work firmly in both directions.

Following the work on the Defiance automatic, the housings are put through a Fay automatic, Fig. 5, which roughs the flange joints at the center of the rear axle housing where the two bell openings of the left and right side go together. This work is located from the shoulder at the base of the thread for the ring gear adjusting screw. The finish work on the flange joint is done on a LeBlond, heavy-duty lathe, Fig. 6. It requires two of these machines to keep up with the Defiance two-way automatic.

The oil plug holes and oil drain holes in the right half of the housing are drilled on a Fosdick drill press. Both halves are put on a LeBlond machine to face off the end of the housing to an exact distance from the shoulder at the base of the thread. This is solely a locating operation for the next cut which is taken on a Gisholl boring mill, Fig. 7. This is a semi-automatic machine which performs a series of interesting operations, substantially finishing the housing. In these operations, the two halves of the housing are bolted together and the operations are mainly for the purpose of forming the openings which take the pinion housing and finishing the exterior of the housing. Location is from the shoulder and against the face, which was finished exactly in the previous operation. These Gisholl machines perform five to six operations at a speed of 1000 pieces every 9 hr. per machine. It is claimed that to duplicate the amount of work on individual drills would require the installation of at least a dozen ordinary type machines and the employment of eight additional workmen. Furthermore, it would be difficult to hold the same precision of which this heavy machine is capable.

The first operation is to rough face the housing; second, to rough bore the inside and outside diameters. The third operation semi-finishes the inside and finishes the outside. The fourth operation finish faces and chamfers the inside of the housing, and the final operation

reams the finish hole for the housing. McClusky reamers are used for this purpose.

An interesting jig method, Fig. 8, is used to locate for the Gardam multiple-spindle drill, which drills the six holes for the 3/8 in. studs used in connecting the housing to the flange of the pinion shaft casing. Locating plugs enter each side and pilot in the bores in the sides of the housing, and, in addition, the housing is piloted on a dowel in the pinion shaft bore with the drilling operation performed around this dowel.

Before assembly, the threads for the ring gear adjusting screw are re-tapped by hand to insure their accuracy. This is done on both the right and left hand housing. The axle tubes are pressed in position on an Eastern air press, Fig. 9, this being a very close press fit. After being pressed in, the tubes are riveted in place. The tubes are all machined on automatics and are ground on the wheel bearing end prior to assembly.

The operations on the pinion shaft housing are performed in very much the same way as those on the right and left halves of the central housing. A Defiance automatic two-way lathe is used for this work also, Fig. 4. Location on the floating sleeve is on three points and there are also three jaws which act as a universal chuck. In locating the work, the chuck brings the inside flange of the work back against the chuck, the inside of the flange being in contact with the outside of the chuck. The outside of the pinion housing is ribbed and one of the ribs is taken between two jaws in the floating collar which acts as a driver.

The two-way operations on the Defiance machine are as follows: First, on the left side a large rougher enters the bore, and on the right, a small rougher machines another bore. On the left side, the tool roughs out three diameters on the interior of the housing, and on the right side, one diameter. On the right side there is also a spot-facing operation on the end of the housing and a 45 deg. chamfer. The machine then indexes for the next operation. On the left side are drilled six 15/32 in. flange holes. On the right side a tool semi-roughs the small bore and finish faces and finish chamfers it.

Details of Third Operation

The third operation, on one side only, is one in which a semi-finisher goes straight through all four bores, giving true alignment, and also finishes the outside face and chamfers the left side. In timing this machine over a long period, it was found to average 31 1/2 pieces per hr. The limits on the four bores after the final reaming operations on this machine are as follows: 0.0008 in. on the bearing surface; 0.002 in. on the thread surface; 0.001 in. on the adjusting sleeve and 0.002 in. on the tube end. A Warner & Swasey finishes the exterior, particularly the face which goes against the gear housing, and an Ohio tilted rotary miller, Fig. 10, saws the bearing clamp slot. In the latter operation, the work is piloted on its bore over an arbor for location. The pinion housings are spot-faced and drilled and then passed along the assembly line. A progressive system assembly is used.

This is a rather brief outline of the operations which take place in the manufacture of the rear axles. Nothing has been said in this regarding the heat treating department, which is an important unit in this manufacture. Heat treating is used for such parts as the axle shafts and pinion shafts, and heat treating operations are given after the bulk of the machining work is done so that the duty on the cutting tool is as light as possible. The outstanding feature of the axle department is the fact that 800 sets of axles can be manufactured in a day, while with older methods, with the same space and number of men, the plant would hardly have produced a third of that amount.

The Relation of Vehicle Speed to Highway Damage

There is a definite relation between the speed of a motor vehicle and the wearing effect upon the highway. This articles gives the results of some interesting tests that have recently been made to determine this relation. Increased speed of solid tired vehicles increases the impact in far greater proportion than it does in the case of pneumatic tired vehicles.

By W. G. Robertson*

SPEED, for the purpose of this discussion, will be taken in the sense—rate of travel or velocity rather than in the sense—to make haste, perhaps unnecessarily.

It is well known that speed is a very important factor in the amount of destruction which results from the unrestricted use of the roads by vehicles. The impact increases very rapidly with increase of speed. It increases much more rapidly in the case of a truck equipped with solid tires than one equipped with pneumatic tires, because of the greater resilient qualities of pneumatic tires.

A report issued by the United States Bureau of Public Roads on the "Effect of Impact on Pavements" gives some interesting information on this subject, and shows that the impact resistance increases with the velocity, with the total weight of the vehicle, and with increasing road-surface roughness. In these tests, the impact resistance of good asphalt or bitulithic or other smooth pavement, was practically negligible, and reached its highest values on granite-block roads with sand-filled joints, and on badly worn macadam pavements. The rate of increase of impact resistance with speed was most marked on the roughest roads.

The following urban pavements are enumerated in the order of their desirability for vehicle operation from the point of view of tractive resistance at 20 km. (12.4 miles) per hour, as found in this investigation. (1) asphalt, (2) wood block, (3) hard, smooth macadam, (4) brick block, (5) granite block with cement-filled joints, (6) cinder, (7) gravel, (8) granite block with sand-filled joints.

The equivalent grade at 20 km. (12.4 miles) per hour of a badly worn city macadam road was found to be nearly three times as great as that of the best asphalt road tested. This means, at this speed, a consumption of energy at wheel treads of nearly three times as much on level macadam roads as on good level asphalt roads.

Increasing the gross weight of the vehicle by 12 per cent. through load was found to have no effect on tractive resistance within the observed speed limits for smooth roads in good condition; but on rough roads, a distinct increase in tractive resistance with this extra weight was observed.

Tests have been made which show that increased speed of a vehicle equipped with hard rubber tires

tremendously increases the impact which its wheels make on the roadway where there is any unevenness. On the other hand, where pneumatic tires are used, increased speed adds comparatively little to the impact. It has been suggested that these tests will be of great value not only in settling questions of design, but may also lead to a rational basis for determining license fees for motor vehicles.

Trucks have been used in these tests varying in size from a 1-ton up to a 7½-ton truck, carrying an excess load. Each truck was run over a special recording device imbedded in the roadway and the impact which resulted, when one of the wheels made a two-inch drop from a ledge built in the surface, was recorded.

Recent tests were made with a 3-ton truck loaded so that the weight on each rear wheel was 7000 lb., the unsprung portion being 1700 and the sprung portion 5300 lb. The truck was equipped first with an old solid tire that was worn down to a thickness of one inch. Then, with exactly the same load on the truck, a wheel was fitted with a new solid tire 2½ inches in thickness. And finally the truck was equipped with pneumatic tires, 42 x 9 in., blown up to a pressure of 142 lb. per square inch. The following table shows very clearly the bad effect an old tire is likely to have on a road surface and the greatly lessened impact which is produced by trucks equipped with pneumatic tires. The tests show that as the vehicle's speed was increased, the impact from the old hard rubber tire increased greatly. The impact from the new tire was somewhat less.

Speed	Old Tire	New Tire	Pneumatic Tire
5.7 miles	11,600 lb.	9,400 lb.	7,100 lb.
10.2 miles	18,500 lb.	14,100 lb.	7,900 lb.
14.6 miles	26,500 lb.	18,700 lb.	8,330 lb.

In fixing speed limits for motor vehicles, legislators hitherto have given consideration mainly to the question of safety. Diversity of opinion as to what constitutes a safe maximum speed is reflected in the variety of legislation on this subject in different provinces and states. The State of Kansas sets 40 miles per hour as the upper limit of speed in the open country. California and a number of other states draw the line at 35 miles per hour, while 30 miles per hour is about the average for all the states.

Thirty miles per hour is the maximum speed limit in British Columbia, while the other western provinces fix no limit other than requiring speed at all times to be reasonable, having regard to traffic. In Ontario, Quebec

*An address delivered at the annual convention of the Ontario Good Roads Association. Mr. Robertson is secretary-treasurer of the Ontario Motor League.

and Nova Scotia the upper limit has been fixed at 25 miles per hour. New Brunswick sets no definite speed limit other than what is reasonable, having regard to traffic, while Prince Edward Island, but recently opened up to the automobile, puts the ban on a speed in excess of 15 miles per hour.

In this Province the Load of Vehicles Act (Section 5) stipulates that no vehicle carrying a weight in excess of four tons, including the vehicle, shall be operated on any highway at a speed greater than 10 miles an hour; and no vehicle carrying a weight in excess of six tons, including the vehicle, shall be operated upon any highway at a speed greater than 8 miles an hour.

The speed limits for trucks provided in the Ontario act are extremely restrictive. If modified in conformity with recent experience, all commercial vehicles equipped all around with pneumatic tires would be restricted to 25 miles per hour on open country highways, while commercial vehicles equipped partially or all around with solid tires would be required to conform to the following speed schedules:

Gross Weight	Open Country Highways
Under 2 tons	25 miles per hr.
2 to 6 tons	20 miles per hr.
6 to 10 tons	15 miles per hr.
10 to 14 tons	12 miles per hr.

To fix the speed limit of commercial vehicles at an extremely low figure means also interference with the free movement of general traffic on the high-

ways. On a road of average width, when there is a steady stream of traffic in opposite directions, it is at once both difficult and dangerous to pass a succession of slow-moving vehicles in the face of oncoming traffic.

The great increase in motor truck traffic, indeed, points to an early necessity of providing such width on main highways as will enable trucks and slow-moving vehicles to travel the outside of the road and leave a lane of sufficient width for two lines of the more swiftly moving passenger cars. Under present conditions it is just a question whether it might not be conducive to safety to require all motor vehicles to travel at not less than a minimum rate of, say, 12 miles per hour under normal traffic conditions.

Width of highways, degrees of grades and curves, nature of road intersections, ditches, and railway crossings, and volume and kind of traffic are all factors which must be considered in determining speed from the standpoint of safety. So complex are these factors that it is impossible to state what might be considered a reasonable speed on any but a straightaway stretch of country road without taking into account local conditions. Vigilance and sound judgment are essential to safe driving everywhere, and no arbitrary speed limits can be devised which will relieve the drivers of motor vehicles from the ever-present obligation of giving due regard to constantly changing traffic and road conditions.

Peru Offers Possibilities for Truck Sales

PRODUCTS of most of the leading truck manufacturers in the United States are found in Peru, as well as many European trucks. No one make of truck, however, with the exception of a well-known light truck, is found in any great number, though four or five makes of heavier trucks have each a respectable following.

The large number of different makes of trucks is probably due to the fact that consumers or users imported direct from manufacturers, rather than buying from local agents. The amount thus saved in the purchase price was probably offset by extra investment in spare parts, or by having the truck laid up for lack of them. Perhaps both.

There are three prominent fields for the motor truck in Peru. The first is in transporting merchandise from the coast to the commercial centers located a short distance from the seaboard. The leading trade centers of the coastal region of Peru are not situated right on the ocean, but a few miles inland. Lima is some nine miles (12 kilometers) distant from her port Callao. To the north of Lima, Piura is found a few miles from the port of Paita; Chiclayo offers a double opportunity to truck manufacturers, being a few miles from two ports, Eten and Pimentel; Trujillo follows suit, being a short distance from the port of Salaverry. To the south of Peru it is the same story. Cañete is a short distance from the port of Cerro Azul; Chinchá Alta from Tamo de Mora; Ica from Pisco; and Moquegua from Ilo. Despite the fact that railways connect all the coastal commercial centers with their ports, there is a field for the motor truck. This is shown by the fact that trucks are now doing service between Lima and Callao against three forms of competition: mule-drawn carts, steam and electric railway. Further advantages to the truck will soon be evident for the highway for freight traffic between Lima and Callao is to be improved.

A more ambitious project than the linking of the coastal commercial centers with their ports would be a belt line

of trucks joining up the different commercial centers one with another. This doubtless will come in time, for now automobiles are coming to Lima from outlying cities, such as Pisco, and there is a light truck service, perhaps irregular, between the capital and Cañete.

The second field for the motor truck is found on the haciendas or ranches of Peru, which are immense centers of agricultural activity like our western ranches or Southern plantations. From the haciendas the trucks can bring the cotton, sugar and rice to the commercial or trade centers, to be transported to the seaboard.

The third field is in the mines. Although the mining companies now have trucks, American manufacturers should see that they have more and better trucks. This should be easily accomplished, for most of the mining companies have home offices in the United States, and the manufacturer has neither a trip abroad nor foreign credit to consider. Here is export trade on his own doorstep.

At the present time the American motor truck is far in the lead in Peru, and in the field of the light truck bids fair to maintain it. In the heavier truck the European seems to be making more headway for the moment, due, perhaps, to the more favorable continental rate of exchange.

As to the type of truck suitable for Peru, without going into detail, it may be said that it should be a good truck, of the best material and well built; for only such a truck will stand the hard conditions of service in Peru. And any truck sent should be amply supplied with spare parts.

Just why the commercial centers of the coastal region were stuck a few miles back from the sea is not clear. It was probably for protection against the enemy. Be that as it may, it has resulted in putting all of them within truck shot of the coast. Let the American manufacturer plant his trucks on these sites, ready not to destroy but deliver any merchandise that may approach.



The Automobile in Brazil

Editor, AUTOMOTIVE INDUSTRIES:

Twelve years ago the poor pavement of Brazilian streets and the impassable roads of country districts made traveling by automobile in this country an almost impossible task. At the present time, from Amazonas to Sertão in Matto Grosso, from Minas Geraes to Rio Grande do Sul our country is covered with beautiful roads of the modern type. In the State of Sao Paulo the "Better Road Movement" has taken unusual progress since the present governor, Hon. Washington Luiz Pereira de Souza, was appointed to office. The Hon. Pereira de Souza is personally a great motorist, and one of the first steps he took after being elected was to use his influence in having the municipal governments of the leading cities within the state to appropriate sufficient funds for the construction of new roads and the upkeep and improvement of the old ones. During the first two years of his administration great headway has been made in road construction and improvement. In addition to numerous smaller roads, his administration should be credited with the remarkable Sao Paulo-Campinas road, 105 kilometers long. The State of Paraná has likewise an enterprising governor who has successfully promoted road construction within his state. Notable examples of newly built roads in Paraná are the 800-kilometer road from Ponta Grossa to Iguassu and others of shorter distances.

As a matter of fact, in all Brazilian states there is to-day an evident desire for better roads. This desire varies in intensity, it being dependent upon local wealth and natural resources. Nearly 150 kilometers of the interstate road from Rio de Janeiro to Sao Paulo have already been completed. Funds for this interstate road are provided by the Federal Government and the state government of Sao Paulo.

Roads, of course, have made it possible to introduce the modern automobile in our country. And among the cars used the American is found in larger numbers than those of European makes. We can state with emphatic assurance that public officials, as well as our leading plantation owners and farmers, merchants, etc., throughout our country, are beginning to realize the fact that automobiles, motor trucks and tractors are indispensable means of transportation and agricultural and industrial progress. Cars are to-day used for practically the same purposes that horse carriages and animal-drawn vehicles were employed years ago. Notwithstanding this remarkable progress in automotive vehicles, Brazil is in its infancy as yet when we consider the fact that three, four or more times the number of present cars could be used throughout the country.

In spite of the commercial depressions, past and present, the automobile trade is one of the most solidly built activities of our local trade. In no city has the popularity and use of the automobile decreased. Taxi companies are prosperous. The people have come to look upon the taxi with the same regard as street cars. It

has even taken the place of the horse and the omnibus; taking the place of railroads, has solved the long-distance transportation.

The future of the automobile in this country is in the hands of those manufacturers who will strive for producing better cars and giving Brazilian importers and dealers better service and facilities. At the present time the American car is supreme in our markets; but this supremacy is likely to be lost to American manufacturers if they fail to make special efforts now to retain it. It will not take a great effort on the part of German manufacturers to compete with the Americans. Our exchange on the German mark is far more favorable than on the American dollar. There is always the possibility of German manufacturers coming to this country, looking up local requirements and going back home to build cars in just the manner that our buyers like to have them built and delivered. Germany just now is working hard to introduce her latest models. German manufacturers are looking for big business, and we believe that, with the advantage of the mark exchange in our favor, they will have no difficulty in introducing again their products. Of course, we must always bear in mind that American manufacturers are more advantageously equipped for the business, when we consider this advantage from the viewpoint of repair parts and mechanical equipments for car servicing and repairing. The handsome body styles and mechanical improvements are also to their advantage.

Our state of Sao Paulo should be considered as being the "leader" in our country in connection with automotive activities. Our state has to its credit a larger road mileage, and 15 large concerns devoted exclusively to the importation, sale and service of automotive products. These concerns handle American cars almost exclusively, in addition to tires, accessories, etc., of American makes. They handle about 50 per cent of the total automotive trade of Brazil. In view of these facts, American manufacturers should turn their attention to our state.

Among the most important things that American manufacturers should look into are the following:

(A)—Protection to representation granted to Brazilian firms or individuals. Agencies should be established on permanent and sure basis, so that agents or representatives will handle it properly through personal interest in the business. Manufacturers should not change representatives as frequently as they have done in the near past.

(B)—To comply with all requirements or specifications indicated in our orders, in connection with finish, color, type of rim or wheel, magneto ignition and others of similar tenor. Most manufacturers disregard these instructions.

In spite of the existing depression weighing upon our markets and which reflects against American-made goods, since the exchange on the dollar is exceedingly high, and curtails importations from the United States, the automobile business has not suffered as much as other lines of activities. It is true that sales have fallen off when compared with normal market, but, however

reduced, there has been a steady stream of orders, and we can say that, all things considered, this has been a fairly good business.

The prospects are brighter for the 1922 season. Brazil will commemorate this year her independence centenary. Those of optimistic mind are hopeful that this occasion will mark the rehabilitation of the exchange with the United States. At any rate, we all hope the coming year will witness an era of rehabilitation and readjustment of our economical life which will mean higher local production and more money in circulation.

Let me now make some brief remarks as to what I consider wise for American manufacturers to do during the present period in order to retain and improve their business and relationship with Brazilian automotive importers and dealers:

(1)—To establish commercial relationship with reliable native firms or individuals. To send traveling representatives to become thoroughly familiar with Brazilian markets, selecting for this purpose men of good manners and of wide experience in international trade able to speak our language and acquainted with our mode of living. Preference should be given to those having technical knowledge of methods and equipments for servicing and repairing automotive products.

(2)—Manufacturers should endeavor, as far as feasible, to give their representatives or important clients long credits. This policy will be found very advantageous in connection with tires, repair parts and accessories, as local buyers usually buy these goods on terms.

(3)—To give more attention to the matter of service to owners, through reducing the price of spare parts. During the past months these have been sold at fantastic prices. Also special attention should be given through manuals or other forms of printed matter, to repair and maintenance methods.

Should American manufacturers follow these leads as closely as possible it will not be surprising to see, say in the course of ten years, that all cars in Brazil are American-made cars. Let me also state the fact that American manufacturers will never find a better market for their cars than our country. Automotive development is here in its infancy. The automobile is just beginning to make headway under the right character of a vehicle of practical utility rather than a conveyance for the wealthy and exclusive.

I write authoritatively on these matters because I have had many years' experience in this line in my native land.

FLORIANO P. SANTOS,
Sao Paulo, Brazil.

Air Cleaners

Editor, AUTOMOTIVE INDUSTRIES:

Referring to your editorial in the Jan. 26 issue on the subject of air cleaners for road vehicle engines, it is unquestionably desirable to employ an air cleaner and particularly on truck engines.

Reference is made to the objection to the use on high speed engines of air cleaners of the type which offers high resistance of the passage of air. An air cleaner of the so-called filter type, while being the most satisfactory from the standpoint of efficiency, fails to function consistently where an excessive amount of dust is handled for the reason that while they can be made self-cleaning, they will not work under severe conditions and quickly become clogged. In this respect, has sufficient attention been paid to the location of the air intake so that the amount of dust the cleaner has to handle is minimized?

In almost every instance, the location of the air inlet is inside the hood, subject to all the dust that is drawn in by the fan through the radiator. It is evident that this loca-

tion is most unfavorable, and tests have indicated that if the air were taken from the driver's compartment, for instance, the amount of dust taken through the cleaner would be reduced by 60 per cent. Under these conditions, a filter type of cleaner of the simplest type can be effectually used.

NORTHWAY MOTOR & MFG. Co.,
Div'n General Motors Corp.,
A. A. Bull, Chief Engineer.

The Vaporization of Motor Fuel

Editor, AUTOMOTIVE INDUSTRIES:

I noted with some surprise your article in the AUTOMOTIVE INDUSTRIES, page 509, of March 2, 1922, headed "A System for Complete Fuel Gasification." I refer particularly to your statement that it is necessary to raise the mixture for the average American gasoline to a temperature of about 425 deg. Fahr.

Your article would lead one to believe that in order to completely vaporize gasoline, the temperatures that must be maintained are fixed only by the end points of the fuels used.

There has been so long a misunderstanding in the automotive industry on the subject of the scientific use of motor fuel, I feel inclined to call your attention to this erroneous statement. It seems to be a recent discovery to automotive engineers that a fundamental scientific fact respecting materials existing in combination is that their characteristics are affected by their environment. Physical chemistry has so long dealt with partial pressures, and the laws of mass action, now fundamental to all chemistry, are so entirely based upon partial pressure, it seems a reflection on the intelligence of technical men to have to refer to the subject.

About a year and a half ago, one of the technical associates of the Deppe Company wrote Dr. Cottrell, then Director of the Bureau of Mines, and called his attention to the fact that the specifications for motor fuel were to be based entirely upon the distillation points under atmospheric pressure, which was wholly misleading, as the fuel was never utilized in that manner. Partial pressures of the fuel, when dealt with in the presence of other matter, have been quite generally overlooked in the automotive industry and yet are fundamental principles of chemistry and physics. It is unfortunate that terms having a definite meaning in science frequently have another meaning in industry. To such an extent has this become prevalent that it is necessary to define the meaning to prevent misinterpretation. Thus, evaporation in chemistry and physics is known as slow vaporization. Evaporation to dryness, for instance, has a very definite meaning in the chemical laboratory. In engineering practice, evaporation, instead of being applied to a slow rate of vaporization is applied to the most rapid rate of ebullition which is practiced in the arts. The performance of a steam boiler is always specified in evaporation per pound of coal or the rate of evaporation per hour and the standard definition of horsepower is technically so specified. Another term having a definite physical and chemical meaning, "vapor tension," has long been used by the Government and the Interstate Commerce Commission to define the allowable pressure permitted on gasoline tank cars. In other words, "vapor tension" has been used under Government sanction for total pressure. It is only recently that a joint committee has pointed out that from the scientific point of view this is not vapor tension. *The term, however, has not been changed.* In selecting a term to be applied in the arts, therefore, its use in such arts must be taken into consideration and not its use alone in the physical or chemical laboratory. Thus it is with "boiling point." There is really no fixed boiling point, the

boiling point being dependent entirely upon the conditions to which the liquid is subjected, each pressure having a different boiling point. By agreement, the standard boiling point of water is taken under standard atmospheric barometric pressure, namely, 100 deg. Cent., at 760 mm. pressure. This standard, therefore, defines these conditions only and does not in any manner attempt to define or limit the fact that there are other boiling points. These boiling points are commonly taken for materials in the liquid mass and not in an atomized or spherical condition. A globule of water dancing on a red hot plate is an illustration of the phenomenon known as "false equilibrium." In this case, the surface tension of the globule has now disturbed the boiling point and the globule no longer boils at normal temperature. Therefore in selecting a term to define under what conditions a liquid may be converted into a gaseous state, consideration must be given to conditions other than temperature and pressure. One is at once confronted with the fact that mechanical sub-division may alter the boiling point independently of the temperature or pressure of its environment and that where liquids are used in mechanical sub-division such as an atomized condition, certain laws relating to the boiling point in the mass no longer hold. In other words, colloidal chemistry is an accepted principle of physical chemistry and has laws that are immutable. It is possible to boil water at 32 deg. Fahr. by reducing the pressure low enough. It is possible to run this temperature up to the decomposition point of water without boiling it if the pressure on the liquid is high enough. Temperature alone means nothing in specifying the boiling points of liquids.

We have read with great interest Mr. Howard's very able paper in which he endeavored to determine the pressures and temperatures at which vaporization takes place, but any application tending to interpret that subsequent condensation cannot take place under changing temperature or pressure is not in accordance with physical laws. Likewise of interest were the very able and ingenious methods proposed by Professor Wilson for determining what he calls an "equilibrium solution," but we have watched in vain for some technologist to ask why the end point of his equilibrium solution became 482 deg. Fahr. whereas his original gasoline had an end point of 410 deg. Fahr. This brings one into a complicated field of physical chemistry but it is so pertinent to the hot spot applications that I cannot refrain from commenting on it. In other words, in applying heat to cracked gasolines, it will be found they are tremendously susceptible to polymerization, and singularly enough while the automotive industry as a whole criticizes the heavier fractions of the fuel, as these have already polymerized, they do not in general have the same tendency to polymerize as some of the lighter fractions which have been temporarily hydrogenated. The subject of hydrogenation has attracted much attention in the past three or four years and is the next debutante to the automotive society. In cracking heavy fuels to produce light motor fuels, if it is desired to produce a high content of saturated hydrocarbons,

probably hydrogenation must be resorted to, the question of whether the hydrocarbons are saturated or unsaturated being determined by well known chemical tests and not by any method of determining whether the molecules have a tendency to remain stable or to become unstable when quickly subjected to heat.

One of the important features in the Deppe process which you fail to comment on (and, by the way, I was not consulted or notified that you expected to publish this article or I should have been glad to have made these suggestions) is the fact that the Deppe method avoids subjecting the mixture to an abrupt cracking or polymerization producing unstable and heavier molecules as shown in Professor Wilson's tests. You will note particularly the emphasis we place on progressive heating and in this respect Mr. Howard's laboratory work followed more closely the Deppe methods by removing the lighter products before the heavier products were acted upon by increasing temperature.

H. P. DEPPE.

We note that Mr. Deppe was surprised to read that it was necessary to raise the gasoline to a temperature of 425 deg. Fahr., from which we infer that this is not the temperature he uses, but we fail to find in his communication any information as to what is the maximum temperature used in his system.

If we consider the gaseous mixture as an absolutely homogeneous mass, it is a comparatively simple matter to calculate what temperature is necessary in order that a mixture of any particular proportion and under any particular pressure may remain in the gaseous state after the fuel has been once completely vaporized. But it is a rather different problem to determine the temperature to which the media which carry heat to the fuel must be raised. For instance, if it were found that the fuel in a certain mixture under a certain pressure would not separate out at a minimum temperature of 150 deg., the medium through which heat was imparted to the fuel must evidently be raised to a materially higher temperature than 150 deg., for if it was not, the gasoline could not possibly reach 150 deg. within a definite time. How much higher its temperature must be would depend upon the time available for the volatilization of the fuel for one thing and the fineness of spraying for another. As to the time factor, if the gas passes through the manifold at the rate of 150 ft. per second and the heating surface is 6 in. long, the length of time that any particular portion of the charge is near the heating element and under its influence is one three-hundredth part of a second.

We do not believe that the vacuum in the intake manifold is a very important factor in this connection, for although the temperature of vaporization is directly proportional to the absolute pressure, and this is comparatively low when the engine is throttled, there are certain conditions of engine operation when the manifold pressure is very close to atmospheric, and the heat supply, of course, must be adequate to meet these most unfavorable conditions.—EDITOR.

Automobiles in Madagascar

FRENCH automobiles are in the lead in the Island of Madagascar, about 116 of the 159 cars there being made by French manufacturers. Thirty-eight cars are of American make, and all but three of these are privately owned. The majority of the French cars are owned by the Government. Two Italian and three British cars are on the island. About three tractors are used for agriculture and about 79 motor cycles are in

use. But seven of these latter vehicles are American.

On the neighboring island of Mauritius, which has a smaller population than Madagascar, there are 1600 cars. On the Island of Reunion there are 30 or 35 cars.

This information has been furnished by the American Consul at Tananarive, Madagascar. American consular officers at any foreign city will furnish such information directly to any American asking for it.

The Study of Car Markets Demands Careful Analysis

The possible future market for any one manufacturer can be determined by an analysis of the past history of his market in its relation to that of all his competitors. The author explains how this may be done.

By Harry Tipper

SO far, in the discussion of this subject, it has been impossible to go any further than the basic economic conditions, the channels of distribution, and the economic requirements of those channels. To be at all effective, these considerations must be applied by the manufacturer of the automobile to the requirements of his own organization, considering the product which he is dealing with, the production and the character of the organization as it stands. In order to do this, the manufacturer must have some very definite way of arriving at

First—The future market for his particular product in comparison with the present production.

Second—The plans necessary to secure that market.

Third—The least operating cost at which those plans can be effectuated.

In order to determine the market, it is necessary to know the fundamental facts concerning

First—Tendency of future registration.

Second—Life of the car.

Third—Variation in the territorial developments in each of the territories.

Fourth—Character and tendency of the competition.

Fifth—Relation in the market in the different price groups as intimately as possible.

Sixth—Tendency as to styles, types and models.

While these elements are also part of the production necessities, they are much more intimately a part of the marketing considerations.

The more efficient concerns tend to grow somewhat more rapidly than the general growth of the business in which they are engaged so that it is possible for the market to be enlarged by an increase of efficiency in the same price group and under the same general conditions of competition. What it means is that the efficient concerns, in addition to absorbing the natural increase of the market, succeed in taking away the potential business from the less efficient concerns so that they grow faster than the increase in the total market by that process. Having in mind these considerations, the general market should be known as to the following items:

(a) The tendency of production and registration with relation to tendencies in population and wealth established. (Some of this information has been given to subscribers of AUTOMOTIVE INDUSTRIES in earlier articles.)

The method of calculating such tendencies is of great importance. The ordinary percentage curve is of no value in such a connection because it is not possible to calculate a normal growth from that so that the future may be

safely predicted. It is necessary that these calculations should be based upon the modern statistical practice in this respect such as is used by the actuaries and of which the application of Gomperz Law to economic factors is the most important example.

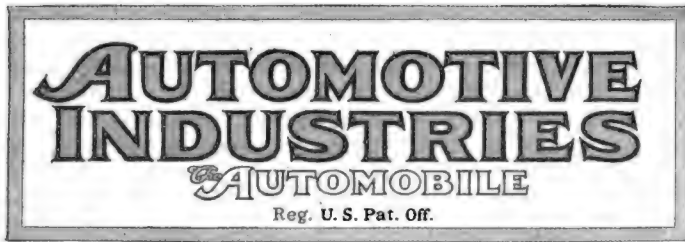
(b) These tendencies should be determined also in relation to the growth of the different automobiles, divided by groups such as price groups, so that the manufacturer will be able to determine the limits of his section of the market as well as the enlargement of the market to be secured from any change in his price policy.

(c) To carry this consideration of the market to the point where a thorough application can be made, the same calculations should be arranged for the different states or on some territorial basis, which would enable the manufacturer to calculate his market for each distributing point and the territory adjacent thereto.

The accuracy with which the past growth of registration, in relation to population and wealth, is considered will almost govern the efficiency of the marketing calculations as to plans based upon these considerations. The total market for new cars is based upon the probable increase in registration. The increase in production capacity in comparison with this increase in registration offers an indication of the probable tendency of competition.

the market in relation to automobiles involving the expenditure of different amounts of money. Properly worked out, this curve will show the true relation regardless of inflation and deflation which may affect prices for a short period.

If the production capacity is growing more rapidly than the registration, especially in certain groups, the tendency of competition will be toward readjustments in values, more intensive marketing efforts, and a more definite pressure on the distribution channels. An examination of these factors in connection with the different states will indicate the variation in the marketing possibilities in those areas and therefore the proportion of business to be expected from those areas and the amount of sales pressure which can be economically put upon each area in order to effectuate the probable sale. It is advisable where possible that the manufacturer should also plot out his own relation to his competitors within the same price group, not from the amount of production so much as from the tendency in



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Leadership

THE position of being a leader entails a responsibility for leadership. Factory officials sometimes fail to realize the weight that is attached to their words or they would, when talking to organization gatherings, pay more attention to preparation of the subject matter.

Selling organizations are especially subject to hearing "wind contests" which may momentarily enthuse them but later, when given sober thought, cause unfavorable reaction toward the subject matter and the speaker. Such contests tend also to lessen the faith which the salesmen may have in the leaders and no dealer organization can succeed without faith and plenty of it.

As competition becomes keener, men need something solid to chew on. Real fighters gain their objective better by knowing the obstacles. The selling organization must be composed of fighters these days in order to win, hence it is up to the leaders to tell these fighters how to overcome the obstacles, not to paint them out with fine words.

Facts, if properly presented, can give a strong stimulus to any organization and who is so well equipped to tell these facts in the right way as the leaders.

Loss of Power at High Altitudes

DURING the period of intense aircraft development we heard a good deal about the loss of engine power at high altitudes and means for eliminating this loss, or at least reducing it. Considerable trouble from this same cause is experienced with automobiles and other types of automotive vehicles in Mexico and South American countries of a mountainous character. For instance, vehicles that are a little shy on power for use in lowlands are quite impractical at altitudes such as found in Mexico.

It is generally held that the power of an engine decreases directly with the density of the atmosphere in which it is operating, but this is not strictly correct as regards the ordinary engine adjusted for use in low countries. In the case of such engines the loss in power is materially greater. There are really three distinct causes of power loss when the engine works in a rare atmosphere. In the first place, the amount of air taken into the cylinder during each inlet stroke is less in direct proportion to the lowering of the atmospheric pressure, and if this air were utilized with equal efficiency as the air taken in when the engine works at sea level, the power would decrease in the same proportion as the air pressure. Unfortunately the air is not used to the same advantage. This is due partly to the fact that the compression is lower, and the thermal efficiency decreases with the compression. On the other hand, the carbureter will be adjusted for operation at low altitudes and will give too rich a mixture at high altitudes. Of course, a mixture slightly richer than that containing just enough gasoline so that all of it can be burned by the air present, will give more power than the theoretically correct mixture, but the carbureter is apt to be set to give this maximum power mixture in the first place and in that case the mixture which it delivers at high altitudes will be over-rich and will give poor economy as well as reduced power.

Of these various causes for the falling off in power of engines at high altitudes some can be readily eliminated. For instance, the change in the mixture proportion can be easily corrected by adjusting the carbureter needle valve or by the replacement of the carbureter nozzle by a slightly smaller one. The reduction in the compression is less easily compensated for. The only real remedy consists in reducing the compression space, which in the case of detachable head engines can be done by planing or milling off the cylinder block top face or the cylinder head, in whichever the compression space happens to be, but this involves the complete disassembling and reassembling of the engine, in addition to the machine work on the block or head and consequently entails rather heavy expense.

The most radical and effective method would consist in providing the engine with a super-charger, as has been done for some time in connection with air-

craft engines for high altitude flying. This overcomes all three causes for the loss of power at the same time. The engine then can be given a full charge, its compression will be the same as at sea level without super compression, and the carbureter will be adjusted to give the proper mixture proportion under the conditions under which charge is forced into the cylinders. Unfortunately, such superchargers cannot readily be attached to the engines of standard cars, and the trouble from loss of power is probably not sufficiently severe and the market in high altitude districts not sufficiently large to warrant the building of special cars embodying supercharging equipment.

Realizing the Problem

THE question often arises as to what can we do now to succeed or make our business progress. This question is apt to be the result of looking the field over with the idea of finding more worlds to conquer; of seeking an outlet for energy as if the mere application of energy was in itself commendable. "What is the problem to be solved?" should, in many cases, be substituted for "what can we do?" It is not a matter of the phrasing of these two questions, but of the attitude of mind as expressed by them.

Careful and accurate analysis of conditions will lay bare the problem and aid in determining the method to be employed in its solution. The realization that there is a problem to be solved tends to co-ordinate effort to be expended and direct it in the proper channels.

Accessibility and Service Costs

NO one who has any knowledge of the service business questions the desirability of construction which is readily accessible, but designers too often neglect this factor, and are so often dominated by considerations of easy production that the problem of the service station is entirely overlooked. A part or an assembly is frequently ideal from the production or assembling standpoint, but when placed in the vehicle is so difficult to dismantle that the time required for the service operation is two or three times as long as it would be if due consideration were given in the first place to making it easily reached and as easily taken apart or removed as it was easy to assemble and install. It is, for example, a simple matter to place a clutch in the flywheel of an engine when the latter is detached from the gearset, as in a normal assembling line, but in some cars it is necessary to not only remove the gearset before the clutch can be taken out, but before this can be done the rear end of the frame must be blocked up, the springs disconnected and the axle moved back!

A reputation for moderate cost for repair work, when this is necessary, is coming to be regarded as more and more important by purchasers who are now car owners and who have, as a rule, had some unpleasant experiences in this line, which, if the truth were known, were in many instances quite largely due to inaccessibility. In any case, service costs must

be decreased, and one important means to this end is the use of accessible construction. Executives should see that this fact is given due consideration by their engineering departments, and should for this reason encourage closer contact between that department and the service stations, to whom they must look for the care of their product.

This situation does not apply to passenger cars alone. It is perhaps more important in the case of trucks and tractors. One of the latest designs of tractor is laid out in such a way that every important unit can be easily detached, in most cases without disturbing adjacent units. To do this has materially increased the cost of the machine, but the manufacturer, who is one of the largest producers in this field, is convinced that the greater accessibility secured will soon offset the higher first cost, and thus prove a better investment for the farmers who buy and must maintain their machines. Can anyone doubt that this is a sane and far-sighted policy?

"God Helps Those—"

EFFECTIVE handling of industrial relations depends chiefly upon the provision of opportunity for the development of the individuals making up the working force. Discontent usually arises, if the trouble is traced to its source, from the fact that too many jobs fail to provide sufficient interest in themselves to allow for continuous personal growth on the part of the worker. In many cases a given job provides neither interest within itself nor training for promotion to more attractive work. One of these factors is necessary.

One excellent way to provide workers with an opportunity for personal development is through the maintenance of an up-to-date and useful factory library. Such a library has been established in a number of automotive plants and serves a useful purpose, especially in those cases where it is kept supplied with current business books and where some effort is made to "sell" the library to the men.

To keep its factory library in condition for maximum use, for example, one of the large truck companies has written to various well-known publishers of business books asking for their latest catalogs. This particular firm has for a long time maintained an excellent general library for its employees, comprising works on economic and social subjects, as well as literature of various kinds. It is now about to establish a technical library. And the interesting part about this factory library is that it is in constant use and has played its part in making successful the broad and intelligent industrial relations policy of the organization.

The catalogs of the better business book publishers might make interesting reading and might furnish some worth-while ideas for those in charge of factory personnel work. To provide workers with books specially adapted to their particular work is to give to these employees an excellent opportunity for self-development—and that old maxim that "God helps those who help themselves" has an important place in any discussion of industrial relations.

Quarter Will Meet Early Predictions

Production of January and February More Than Comes Up to Expectations

By JAMES DALTON

NEW YORK, March 22—Predictions that production of passenger cars and trucks the first quarter of 1922 would show a material increase over the same period in 1921 have been more than justified by the first two months. The February total was approximately 129,500 against 90,486 in January, 78,995 in December and 116,349 in November.

Carload shipments for January and February this year, including the Ford Detroit plant, totalled 34,841 as compared with 16,471 for the same months last year and 45,552 for the same period in 1920, the biggest year the industry ever had. In making comparisons with 1920, however, it is only fair to state that the number of vehicles driven away from the factories in January and February was 73,002 while this year it was 17,347. In 1921 it was 10,692.

March Gain Just as Favorable

But no matter on what basis comparisons are made, the showing thus far this year is very creditable. It is probable the gain this month over March 1921 will be fully as favorable, but it is likely that the other months of the year, except for the last quarter, will show considerably smaller increases as compared with the corresponding months in 1921. There may even be a decline in passenger car production in the third quarter.

Nothing will be gained by exaggerated expectations for the year as a whole. The fact remains, nevertheless, that the industry has made a remarkable recovery since the close of 1921 and that the aggregate of business for the 12 months will be very gratifying.

While passenger car makers, as a whole, had a good year in 1921, the truck manufacturers, with a very few exceptions, did practically nothing and the volume of sales by parts makers was not as large as the production of vehicles would indicate. The proportionate gains in the truck field this year have been fully as large as in the motor car branch of the industry and parts producers have had a substantial increase in sales because the inventories of vehicle builders have been greatly reduced.

Reports from the parts and accessories
(Continued on page 690)

Business in Brief

NEW YORK, March 22—Trading in stocks is on a broad scale and the market is buoyant.

Railroad freight traffic is increasing and the number of idle freight cars is decreasing. This is true particularly in the West.

There is slightly increased activity in the iron and steel industry with plants operating around 50 per cent of capacity.

Improved crop prospects are reported in the Southwest because of good weather conditions. Corn and cotton planting is under way east of the Mississippi, but has been delayed by rain in parts of Texas.

Grain movement from the farms has been restricted somewhat by lower prices, bad roads and increased field activity. Stocks on hand are comparatively small.

Trade in primary textile markets is dull except in seasonal lines. Woolens for spring are fairly active.

Bank clearings for the week ending March 16 were \$6,636,104,000, a gain of 4.8 per cent over the preceding week, but a loss of 4.7 per cent as compared with the same week last year.

There has been recently a considerable decline in exports of wheat, flour and corn.

Factory employment in New York State increased 3 per cent in February.

Activity in building construction continues. Total for 27 Northwestern States in February was \$177,365,000, an increase of 73 per cent over February, 1921.

Little public interest is apparent in the coal strike which seems certain on April 1.

New Overland Plan Has Willys' Favor

Replaces Bank Proposal—Stockholders Will Be Asked for Their Approval

NEW YORK, March 20—Preferred stock holders of the Willys-Overland Co., who hold the veto power, have been asked to approve a plan under which the bank creditors of the company agree to accept \$16,500,000 in 7 per cent bonds, maturing Dec. 1, 1923, to retire the present unsecured bank loans. These bonds would be secured by fixed assets of the company in such a way that the current assets would be available as working capital.

The preferred stock of the Willys-Overland company stipulate that no encumbrance can be placed upon the fixed assets without the consent of holders of 75 per cent of the preferred stock. It is understood that the Stephens interests, which own considerably more than one-third of the preferred, are agreeable to this plan which has been accepted by the reorganized board of directors.

Willys Approves Plan

The new plan, which also has been approved by John N. Willys and the officers of the company, as well as by the directors, is a very material modification of the reorganization proposition originally worked out by the bank creditors. The first proposal was that the company should be permanently refinanced by issuing \$25,000,000 in first mortgage bonds. The bank proposed to pay \$18,000,000 of this amount to pay the \$16,500,000 bank loans and commissions incidental to them. The other \$7,000,000 would have been held for emergencies as working capital.

The proposition for a mortgage bond issue met with the unalterable opposition of Willys and the Stephens interests. When the bankers found that it would be impossible to have it accepted either by the directors or by 75 per cent of the preferred stockholders, it was revamped into the program which has been accepted by the directors.

The new Toledo directors of the company were in New York for two days last week, conferring with the bankers, and it is understood that a complete agreement was reached. John N. Willys will remain as president of the company, and the bankers expressed gratification because C. B. Wilson, the vice-president, has been made general manager.

The following statement, in reference to the refinancing plan has been issued by Ralph Van Vechten, vice-president of the Continental and Commercial National Bank of Chicago, and chairman of the Bank Creditors' Committee:

The Willys-Overland company has per-
(Continued on page 690)

Stevens-Duryea Asks for 6 Months' Extension

SPRINGFIELD, MASS., March 21—Stevens-Duryea has mailed letters to its creditors asking for an extension of six months to meet its obligations. The annual meeting, which was set originally for March 13 but postponed, has again been postponed until March 27, and it is considered unlikely that it will take place at that time, as more time probably will be required to present an intelligent and satisfactory report to the stockholders.

George M. Berry, treasurer of the company, says the general outlook has improved, but that it is difficult to borrow money for working capital at this time. He is hopeful that the extension will be granted and believes that if it is, the difficulties of the company can be worked out satisfactorily.

The plant, which has been running three days a week some time past, has been placed on a five day a week basis, curtailment in certain departments.

Samson Plans Made for Financing Sales

Provide for Payments for Tractors According to Income Farmer Receives

DETROIT, March 20—General Motors Acceptance Corp. has worked out a series of plans for the financing of sales of Samson tractors and farm implements to the farmers, whereby the payments are arranged according to the income of the buyer from his products. Examples of the way the plans operate are as follows:

Ability to Pay Considered

Plan No. 1 is recommended for sales to dairy farmers or those having a regular monthly income. This provides for a down payment of 30 per cent in cash and equal monthly payments over a period of twelve months or less, according to the ability to pay.

Plan No. 2 is recommended for sales to farmers raising cotton or other yearly crops. This provides a down payment of 40 per cent in cash and the balance in one payment in twelve months or less.

Plan No. 3 is recommended for sales to farmers raising an annual crop and live stock. This provides for two payments, the first in six months or less, the second in twelve months or less, with a one-third cash down payment.

Plan No. 4 provides for two deferred payments of eight and eighteen months with a down payment of 40 per cent. This permits the final payment to be spread over two crops and allows the use of the tractor and implements in preparing the soil for each crop.

Plans also have been worked out for the disposal of used cars or trucks taken in by dealers in the rural districts in part payment for tractors and implements. One of these provides for a 40 per cent down payment with equal monthly payments for twelve months or less. The other is for 50 per cent down with one deferred payment in seven months or less.

Provision for Rebate

On the monthly payment plan a rebate of one-half of one per cent a month will be made where the entire indebtedness is met before due. A rebate of one per cent a month is allowed for each month of anticipation under plan No. 2. Under plans No. 3 and No. 4 the rebate is one per cent a month on each payment prepaid for each full month of anticipation.

The wholesale plan is a method of financing factory shipments of Samson tractors, trucks and power implements to be stored either in a warehouse or on the dealer's showroom floor. Under this plan, Samson products may be shipped by freight direct to the dealer or by the manufacturer to a sub-dealer for the account of the direct dealer.

Only enough products are financed to enable the dealer to have a representative stock and to enable prompt delivery to customers. No stock will be financed

TANKS FOR THE JUNGLE

LONDON, March 8 (by mail)—Sir Frederick Lugard, thirty years administrator in British Tropical Africa, says in a book just published that mechanical transport has a big future in Africa.

He considered it unnecessary to build railroads and metalled roads through the jungle, and suggests that tanks similar to those used in the war should be adopted instead. "Roller-track" vehicles, he claims, would create rather than destroy roads, and would be very economical in running.

These tractors should be of 100 H.P., and capable of drawing 20 ton trailers.

which the dealer cannot sell at retail before the maturity of the note. All papers in connection with the transaction are handled through the local bank of the dealer. The dealer must pay 15 per cent of the invoice price of the products. The differential charged by the company is three-quarters of one per cent on the 85 per cent financed. Products remain the property of the finance corporation until fully paid for. If paid before maturity of the note, refunds of one-fortieth of one per cent are provided for each day the money is not used after the first month.

No notes covering invoices will be drawn for more than six months, because no more should be bought than can be sold in six months. Wholesale indebtedness should be cleaned up at least once a year, the company holds, at a time when collections are best in the territory. This clean-up date will be determined by the acceptance branch under which the dealer is operating and which will notify him.

Under the wholesale finance plan all products will be financed. Under the retail plan, Samson power-drawn implements will not be financed except when sold in conjunction with a tractor. Bank fees are paid by the corporation for handling the wholesale transactions. Insurance on products up to the time the dealer note is paid is covered by the differential rate.

Ford Extends Working Week and Increases Employees

DETROIT, March 21—In connection with its extension of manufacturing to a five-day week schedule, starting this week, the Ford Motor Co. is increasing the number of employees to round out the forces in all departments.

A considerable number will be added over a period of weeks bringing the total close to the 48,000 mark. In a letter to American Legion officers in this city, Edsel Ford, president of the company, said ex-service men would be favored as far as possible in making assignments to the new work.

New Company Likely for Old Times Square

Provision Made in Reorganization of Consolidated Distributors to Pay Creditors

NEW YORK, March 21—The Consolidated Distributors, Inc., formerly the Times Square Auto Supply Co., which went into receivership, is to be reorganized through the formation of a new corporation, if a plan being considered by the reorganization committee is adopted. The new company, it is planned, would acquire such assets of the old company not disposed of by the receiver or in connection with the reorganization plan.

Under that plan the new company would issue four year notes and first and second preferred and common stock. Banking creditors consenting to the reorganization would receive 100 per cent of their claims in the notes, carrying a 6 per cent interest rate, or in participation certificates of one of the banks as trustee for all the banks.

To Pay 65 Per Cent of Claims

The general creditors, exclusive of loan creditors whose claims are subordinate to bank loans and of holders of scrip dividends, would receive 65 per cent of their claims in first preferred stock of \$10 par value and cumulative as to 7 per cent dividends. The present stockholders would be given a share of new second preferred stock for 10 shares of old common stock. What use would be made of 300,000 shares of common stock which would be issued has not been announced.

Shuler Axle Acquires Assets of Old Company

LOUISVILLE, KY., March 18—The Shuler Axle Co., Inc., has acquired the entire assets of the Shuler Axle Manufacturing Co. and is already in operation on the production of front axles for motor trucks, trailers, tractors, etc.

W. F. Robertson of Cincinnati, president of the Robertson Steel & Iron Co., is president of the company, and W. H. May of Louisville is secretary and treasurer.

The company is beginning operations with a paid-up capital stock of \$150,000, which assures ample cash resources for immediate and continuous development of the business. The line of front axles which was made by the Shuler Axle Manufacturing Co. will be continued and plans have been completed for additions to the line.

Frank A. Shuler will continue to act as general manager of the new company and will have personal charge over the increased manufacturing program. Harry W. Helms has been retained as sales manager. Other department heads who have been with the Shuler organization since its inception will continue with their previous activities.

Elgin Stockholders to Help Boost Sales

Asked to Secure Names of Prospects for Reference to Local Dealers

CHICAGO, March 18—A sales boosting meeting attended by about 2000 stockholders was held at Orchestra Hall here by the Elgin Motor Car Corp. in preparation for the marketing of the new model Elgin, which was exhibited at recent shows. A chassis of the model was displayed and its various improvements from an engineering standpoint were explained. The stockholders were requested to gather names of prospective purchasers and send them to the general offices of the company at Argo, from where they will be referred to dealers in the localities from which they came.

This plan of aiding sales was explained by C. S. Rieman, president and general manager of the company, who said that the word of mouth advertising resulting from such stockholders' meetings was of great value. He pointed out that in addition to the 2000 attending the meeting, 17,000 other stockholders who are scattered throughout the country would receive a full report of the proceedings and would be asked to assist in the sales plan.

Production of the new model has not yet started, and the prices at which the various styles will be retailed have not been announced. The car will be made in phaeton, roadster, coupe, sedan and sport bodies. It will have a 118-in. wheel base.

The meeting of stockholders was addressed by Mayor William Hale Thompson, A. Vere Martin, vice-president of the Lake State Bank, and President Rieman.

Governors of Aeronautical Chamber Choose Officers

NEW YORK, March 17—At a meeting of the executive offices here, the board of governors of the Aeronautical Chamber of Commerce of America, Inc., elected the following officers:

President, Grover C. Loening, president of the Loening Aeronautical Engineering Co.; first vice-president, Charles F. Redden, president, Aeromarine Airways, Inc.; second vice-president, C. C. Witmer, president, Airship Manufacturing Co. of America; treasurer, B. E. Bushnell, director of sales, Stewart Hartshorn Co.; secretary and general manager, S. S. Bradley, Manufacturers Aircraft Association, Inc.; assistant secretary and assistant treasurer, Luther K. Bell.

U. & J. SALES PLANT BURNS

CHICAGO, March 20—The U. & J. Sales Co., manufacturer of carburetors and other automobile accessories, whose factory at 507 West Jackson Boulevard

was destroyed by fire March 14, announces that it will lease or buy another building and resume production at once. The company's loss, including machinery and stock, was about \$200,000. About 100 employees were affected. C. A. Kemper, sales manager, said that the company's patterns were at the foundry and were not destroyed.

Worker Succeeds Tolles as President of Phoenix

EAU CLAIRE, WIS., March 20.—C. L. Tolles, for many years president and directing head of the Phoenix Manufacturing Co., manufacturing heavy duty tractors, log haulers and logging and sawmill equipment, has resigned, although remaining a stockholder and director. Robert D. Briggs, secretary and treasurer also has resigned these offices.

Tolles is succeeded by J. G. Worker, vice-president and general manager. H. J. Thompson takes the place of Briggs as secretary and treasurer. A movement is under way to consolidate the Phoenix company and the McDonough Manufacturing Co., of Eau Claire, the latter manufacturing metal and wood working machinery, machine tools, saw and planing mill equipment, etc. Both concerns operate foundries and machine shops.

Coats Steam Car Removes Sales Offices to Chicago

CHICAGO, March 20 — The Coats Steam Car Co. has moved its general sales offices from Indianapolis to Chicago and established them at 2337 Michigan Avenue where G. A. Coats, president of the company, will make his headquarters. Miss I. Siefker is office manager.

The company has acquired the factory of the Stewart Motor Car Co. at Bowling Green, Ohio, and announces that it expects to start production in the near future. The program of the company calls for a minimum output of 10,000 cars the first year, and on this basis officials state that the first year's production is already oversold. A phaeton and a roadster will be made, each to retail for \$1,085, and it is planned to produce a sedan later at \$1,495.

The output of the Bowling Green factory will be marketed under the name of the Stewart-Coats Steam Car.

New Rolls-Royce Price Proves Big Sales Factor

SPRINGFIELD, MASS., March 18—Rolls-Royce of America, Inc., reports that the new price established two weeks ago has greatly stimulated interest, as expressed in sales as well as inquiries from all parts of the country from persons who are inclined to invest either in the phaeton or some special custom body design.

More cars are being turned out from the plant than at any time since production was resumed in the fall, and the prospects are that the plant force will be further increased April 1.

Franklin to Build Four at Syracuse

Good Labor Conditions Figure in Decision—Sixteen Cities Bid for Site

SYRACUSE, March 20—H. H. Franklin, president of the H. H. Franklin Manufacturing Co., has set aside all rumors that the Franklin Four, which will be on the market in April, 1923, will be built outside Syracuse. Following a conference of officials, he announced that Syracuse had been selected for the new plant which, it is estimated, will cost between \$2,000,000 and \$3,000,000. Sixteen cities made bids for the plant's location.

Definite plans for the production of the new car have not been developed, although a general working organization has been formed. It will take a year at least to have the new plant ready for operation, but it is understood that the big Messina Springs tract of 1000 acres just beyond the city limits will soon be the scene of construction not only of the Franklin factory but of an immense housing project.

Production in Present Plant

The first Franklin Fours will be made in the plant here. This is made possible by construction work completed a few months ago. Production of the Franklin six cylinder will not be reduced because of the new model. It is planned to manufacture 40 cars a day, with production steadily increasing.

Labor conditions are said to have been a big factor in the decision to stay here. Not since the Franklin company started manufacture has there been a strike in the plant. Relations between the company and its employees have been singularly happy and harmonious.

The development of the sales force is proceeding. A. G. Maney, vice-president, states that Franklin representation throughout the country will be greatly augmented this year to handle the new Four when it is put on the market.

"We are setting our mark at 250 new dealerships to begin with," Maney says. "But this number will be gradually added to in order to care for the distribution of the Franklin Four. We now have over 500 dealers and expect in time to have several thousand so that Franklin service may be made practically universal."

Boston Bankers Provide Wills \$6,900,000 Credit

DETROIT, March 21—Arrangements have been made with Boston bankers by C. H. Wills & Co., maker of the Wills Sainte Claire car, under which they will be provided with a revolving credit of \$6,900,000, which will run until July, 1923. This will provide a working capital entirely adequate to meet all needs and will relieve the company of all financial worries for more than a year, at least.

Campbell Is Named McGregor Successor

**Latter's Widow Is Given Place on
Directorate of Ford's Cana-
dian Company**

DETROIT, March 18—Wallace R. Campbell was named first vice-president and treasurer of the Ford Motor Co. of Canada, Ltd., to succeed the late Gordon M. McGregor, at a meeting of directors this week. Campbell was formerly secretary, assistant treasurer and assistant general manager of the company. Henry Ford is president.

When the Ford Motor Co. in Detroit was undergoing reorganization of its personnel a year ago, an effort was made by Ford to induce Campbell to join the Ford forces on this side of the border, first as general manager and then as treasurer. Campbell spent several weeks at the Highland Park plant at Ford's request and then decided to continue his allegiance to the Canadian company.

Mrs. McGregor will succeed her husband as director during the unexpired term of his directorate. This appointment was conferred as a tribute to the results achieved by McGregor in the development of the company from a \$125,000 corporation to its present \$10,000,000 capitalization.

P. W. Granjean, assistant secretary, becomes secretary and assistant treasurer. Other appointments to positions made vacant through the promotions are deferred temporarily.

Ford Ideas on Efficiency Carried to Lincoln Plant

DETROIT, March 17—Reorganization of factory facilities at the Lincoln plant to meet Ford ideas on efficiency are being carried through rapidly so as to whip the plant into shape for increased production. This work is progressing under the direction of Charles E. Sorensen, director of all Ford manufacturing operations, and P. E. Martin, Ford factory superintendent.

There is a likelihood of all the executive offices of the Ford company being housed in the Lincoln office building because of its position midway between the Highland Park and River Rouge plants.

Fire, Theft Underwriters Aiming at Uniform Policy

PHILADELPHIA, March 18—Automobile fire and theft underwriters are studying conditions closely to come to a uniform policy in proposed new forms of contracts. The losses incurred last year caused a general movement by underwriters toward a drastic change in the valuation of coverage. Falling prices of cars created a bad moral risk under established contracts.

At present some companies are issuing policies at a smaller cost, but cover-

ing only 75 per cent of the market value of the car at the time of loss. Others are keeping in force old forms, which cover the loss in full at increased rates. However, the tendency is to adopt the newer form. Some companies are contemplating issuing a graduating policy, the premium being graduated in accordance with the moral risk.

Kentucky Tables Bill to Put Dates on Tires

LOUISVILLE, KY., March 18—The bill of Representative E. A. Gullion of Henry County to require tire manufacturers to stamp the date of manufacture on tires sold in Kentucky was tabled in the House of Representatives.

F. J. Humbert, representative of Louisville, led a fight on the bill, asserting that its passage would work an unjustified hardship on tire manufacturers and dealers.

All Production Meeting Will Be Held by S. A. E.

DETROIT, March 20—The Detroit section of the Society of Automotive Engineers will hold a production meeting on March 24 at the Board of Commerce. The program represents an innovation, as it will be the first time the society has had a 100 per cent production meeting, according to the officers of the section.

The subject will be largely concerned with the manufacture of automobile gears, and the program is designed to include the men who produce the tools, those who furnish the machines, and those who use both the tools and machines actually to produce gears.

Papers will be presented as follows: S. O. Bjornberg, Illinois Tool Co., "How to Use Hobs"; R. S. Drummond, Gear Grinding Co., "Gear Grinding Machines"; John Edgar, Barber Coleman Co., "Hobbing Machines," and F. Lamborn, Dodge Brothers, "Hobbing Experiences."

Durant Motors Will Add to Its Plant in Canada

TORONTO, March 21—Several important announcements in reference to Durant Motors of Canada, Ltd., were made at a luncheon given by E. A. Wallberg, manager of the Toronto branch.

He said that new buildings would be added to the plant in the near future. The first will be a three-story fireproof structure, 600 ft. by 80 ft., one of the largest factory buildings in the Dominion. The Electric Auto-Lite Co. of Toledo is ready to install machinery in this building.

In addition to the Durant four and six, the Canadian plant at Leaside will turn out the Star and the Mason high-speed 1-ton truck.

Durant Motors of Canada will build at Leaside this year a school for the children of employees, and when building prices come down, will construct model houses for workmen.

Continues Petition to Sell Auto Stores

**Creditors Seek Plans to Effect
Greater Return Than at
Public Sale**

PHILADELPHIA, March 20—After counsel for the creditors had objected on the ground that their clients had no opportunity to express their desires, Judge Thompson, in United States District Court, continued a petition by receivers of the United Auto Stores, Inc., for permission to sell its assets.

The court ordered the receivers to issue notice to stockholders and creditors that the assets would be sold. Joseph L. Kun, assistant district attorney and counsel for the receivers, declared that the expenses of maintenance of the office here and the fifty-eight branch stores were greater than the income. As the result, stockholders and creditors of Edward B. P. Carrier, the 28-year-old promoter, he said, were incurring greater loss.

Jacob I. Weinstein and James J. O'Brien, representing the creditors, suggested a plan might be devised for the sale of the accessories at prices that would be better than for articles offered at public sale.

A tentative proposal, according to Abraham M. Ross, one of Carrier's lawyers, has been made by a group of accessory dealers in New York.

Former Jefferson Rubber President Is Arrested

JEFFERSON, WIS., March 20—Officials of the Jefferson Rubber Co. caused the arrest at New Castle, Ind., of Robert W. Lyons, promoter and former president of the company, on charges involving alleged shortages of about \$3,000, said to have been discovered upon examination of accounts for income tax return purposes. A warrant also has been issued for C. R. Girton, associate of Mr. Lyons in promoting the company.

The Jefferson Rubber Co. was organized two and a half years ago, with \$300,000 capital, and erected a plant, equipping it for the manufacture of tires, tubes and mechanical rubber goods. In the fall of 1921 a reorganization was effected, Jefferson stockholders taking entire charge. Lyons and Girton left Jefferson shortly thereafter.

TEMPLAR DECISION DELAYED

COLUMBUS, March 17—Judge Warner in the Franklin County Court has taken under advisement definite action in the receivership proceedings brought against the Templar Motors Co. by N. Clyburn of Washington, D. C., as a stockholder. The defendant company and officials have filed a long brief, and this is being considered. Decision will not be rendered until the evidence has been gone over.

Milwaukee Business Is on Old Bookings

While Parts Makers Report Better Situation New Trade Develops Slowly

MILWAUKEE, March 20—Indicative of the increased passenger car production growing out of a slowly but steadily improving early season demand is the fact that manufacturers of automotive parts in this market are daily receiving more shipping directions on contracts.

New business, however, is developing very slowly, the output being confined largely to the needs of regular customers whose bookings were made some time ago, with flexible delivery specifications framed because of the impossibility of anticipating current needs until the retail selling season opened and the demands upon car builders could be judged more accurately than in advance.

Manufacturers of patented automotive equipment are able to operate at a better schedule than other parts industries. This is due to the improved call from distributors and jobbers of such equipment catering to owners. The demand for standard accessories used as stock equipment by passenger car builders has increased proportionately to the call for engines, frames, transmissions and other major as well as minor parts.

Weather Helps Local Trade

A week to ten days of balmy spring weather, following a period of similar length when typical extreme winter conditions existed, has had a markedly beneficial effect upon retail sales of passenger cars here. During most of the past week temperatures were abnormally high for this season, with plenty of sunshine, and as a result there was a touch of "spring fever" which was reflected by a quickened call for cars.

The best business is reported by dealers featuring cars in the price class of \$900 to \$1500 for open types, and up to \$2000 in closed types. However, Ford sales are showing a seasonable increase, and dealers in the higher range of values say that prospects are more amenable to reason, with sales gradually increasing. Prospects for sales in April are regarded as much more favorable than they were a year ago at this time. This is not a mere guess on the part of dealers, but a prediction based on analysis of the market.

Packard Not to Abandon Twin Six Manufacture

DETROIT, March 21—Alvan Macaulay, president of the Packard Motor Car Co., has issued a statement to distributors and dealers pointing out that there are more than 30,000 owners of Packard twin six cars in the United States and that the company, despite persistent

RACINE REPORTS SHOW IMPROVED CONDITIONS

RACINE, WIS., March 20—The industrial situation in this city, the second largest in Wisconsin and a center of the automotive and power farm equipment industries, has improved materially in the last two to three weeks. Some of the high lights are:

Mitchell Motors Co.—In a better position than for four to six months past. Orders picking up in all sections.

J. I. Case T. M. Co.—Gratifying reception accorded new Model X, five-passenger car. Production on both models increasing. More than 500 Case tractors sold in 60 days. Inquiries more numerous.

J. I. Case Plow Works Co.—Business improvement advances date of resumption of active production with 350 to 400 operatives, on Wallis tractor.

Harvey Spring & Forging Co.—Booked all spring needs for passenger cars of Nash, Mitchell and Case. Setting up remaining equipment. Plant on full capacity schedule; some departments working overtime.

H. & M. Body Corp. Force being increased. Original order from Hupp for 1922 bodies, numbering 10,000, increased to 20,000. Orders from Mitchell and other factories booked. Reinstatements made generally. Seeking more skilled workers.

Walker Manufacturing Co.—Motor equipment orders increasing, especially on jacks. Prospects best in six months or longer.

rumors, has no intention of abandoning the twin six manufacture.

"The twin six must of necessity command a relatively high price," he said, "and we decided four years ago that we would not cater exclusively to the high price field but would make a Packard car to sell at a lower price. That is the reason for the company's presentation of the single six."

University Is Preparing Automotive Steel Experts

MADISON, WIS., March 20—To meet the increasing demand of motor car and parts manufacturers and other makers of machinery for highly trained men to make metallographic analyses of alloys and alloy steels, the department of mechanical engineering at the University of Wisconsin, Madison, has organized a new course in metallography with an enrollment of sixty-five students, under Prof. E. D. Fahlberg.

Mechanical engineering students are required to take the course so they may make the kind of study of alloys and alloy steels needed in shop work.

Truck Makers Buy on Greater Scale

Car Builders Also Help in Encouraging Parts Manufacturers in Detroit

DETROIT, March 21—Parts makers in the Detroit district have been greatly encouraged by the volume of business which has come to them since the turn of the year. A considerable number of plants are approaching an output of 50 per cent of capacity.

While the major part of the business has come and continues to come from a comparatively few companies, releases and new orders for supplies are coming in smaller volume from most of the companies in the industry. This would indicate that all manufacturers are sharing in the increased sales of motor cars. Truck builders also are buying on a scale which demonstrates a better market for commercial vehicles.

Some Report March Best Month

At a recent meeting of credit men representing some twenty-five companies in the Detroit and Cleveland districts, reports of better business were almost unanimous. In most cases February sales were at least double those of January, and in a few instances much more than that. March business in many instances will double those of February, and April will be better than March. Two or three reported that March will be the best month they ever had.

Collections on current business are excellent.

The chief element of doubt in the minds of the parts makers is what is going to happen after April, for they have few specifications beyond May 1.

Bearings Service Co. Makes Additions to Field Force

DETROIT, March 20—J. L. Whalen, former central district manager of the Bearings Service Co. of Detroit, has been named assistant sales manager and assigned to the central district with headquarters in Detroit. W. H. Anderson, former New York branch manager, has been named assistant sales manager and assigned to the eastern district, with headquarters also at Detroit. W. C. L. Hodgson will remain in Detroit as one of the assistant sales managers and has been assigned to the southern and western districts.

A. H. Pratt is now the company's New York branch manager. C. R. Norris, formerly branch manager at Newark, will be assistant manager. P. W. Daniels, assistant at the Philadelphia branch, has been made Newark branch manager. G. M. Flyum, former manager of the Brooklyn branch, has been succeeded by N. B. Keller, who resigned as manager of the Minneapolis branch.

Standard Mould Co. Resumes Dividends

**Suspended Payments During
Slump, in Company with
Other Akron Manufacturers**

AKRON, March 18—The Akron Standard Mould Co., manufacturer of rubber making and tire building machinery, is the first of the many Akron companies which were forced to suspend dividend payments during the slump in the automotive industry, to resume such dividend payments.

Announcement that the company will resume common stock dividends April 1 is considered one of the most important and optimistic developments in the rubber metropolis since the restriction of credit and diminished sales first forced all Akron companies to retrench and lay off thousands of men over a year ago.

Directors of the company have declared a 1 per cent dividend payable April 1 to stock of record March 15. It is understood the company expects to maintain the 1 per cent dividend payable monthly in the future, having paid all of its bank indebtedness.

Reflects General Improvement

Although the Akron Standard Mould Co. is not essentially a rubber factory, by reason of the fact that it specializes in tire building machinery, including tire moulds and cores, its existence and growth naturally depend solely upon the prosperity of the tire industry, and the fact that it is able to resume dividends is accepted as a definite reflection of material improvement in the tire industry in general. The company reports sales of \$500,000 last year and announces that business is steadily increasing.

With very few exceptions all Akron manufacturers suspended dividends during the low ebb of the slump period.

Others are expected to follow the lead taken by Standard Mould, indicating a marked degree of improvement and a substantial stride toward normal.

New Selling Organization Incorporated in Porto Rico

SAN JUAN, PORTO RICO, March 15 (by mail)—Certificate of incorporation has been issued to the Porto Rico Tire & Rubber Co., Inc., with offices here and with an authorized capital of \$50,000. The corporation, it is stated, will dedicate itself principally to the purchase and sales of automobiles and automotive equipment. The incorporators are A. Panzardi, L. Garcia Mendez, Ignacio Guasp and J. Gutierrez Guasp, all of San Juan.

Attention is directed to the possible confusion of the name of A. Panzardi, one of the incorporators, with that of Santiago A. Panzardi of the company of Santiago A. Panzardi, Inc., an old

BUSINESS IN MARCH EXCEEDS ALL FOR 1921

MILWAUKEE, March 20—The Lavine Gear Co. of this city announces that its shipments of gears this month will be greater than its shipments for the entire year of 1921.

established firm that has represented several American cars for ten years or more and has branches throughout the Island. Santiago A. Panzardi, general sales and service manager of this corporation, is not connected with the new Porto Rico Tire & Rubber Co.

Stearns Declares Dividend; Iowa Resumes Ordering Cars

CLEVELAND, March 20—A quarterly dividend of 50 cents a share has been declared by the directors of the F. B. Stearns Co., maker of the Stearns car. This is one-half the rate that has prevailed since the stock was changed from a par value of \$25 to no par.

President George W. Booker stated that business in March is better than it was the preceding month and that inquiries indicated the records would be better during the months of April, May and June. It also was stated that the first order received from Iowa for some time came into the factory last week.

Heavy Rains Prevent British Tractor Test

LONDON, March 3 (by mail)—The tractor demonstrations organized for March 1 and 2 near Exeter, England, have been cancelled owing to the effect of heavy rains on the soil. These were the first of a series of three demonstrations which were planned for early spring, summer and autumn this year, to be held in various parts of the country, instead of a national trial in the autumn.

Fifteen tractors, three self-contained rotary tillers and one garden cultivator had been entered for the event, which, incidentally, was the first tractor trial or demonstration organized in England canceled or even postponed.

The heavy rains during the latter end of February, however, had rendered plowing out of the question for at least a week after the arranged dates, even if continuous fine weather could have been relied upon for the first part of March.

FEES SHOW ONTARIO GAIN

OTTAWA, ONT., March 18—The Ontario government expects to get the sum of \$3,500,000 from the licenses of motor vehicles in the province. This will mean an increase of about \$500,000 over the figures for the past fiscal year. An order-in-council has been passed by the Ontario government making a nominal fee of \$1 per annum payable on all motor vehicles owned by municipalities.

Fisher Body Extends Factory Facilities

**Leases Plant in Cleveland—Stand-
ard Parts Business in 1921,
\$7,233,033**

CLEVELAND, March 18—Two of Cleveland's largest industries, both of which are allied with the automotive industry, are riding along on business waves that are breaking more smoothly than they have for the past two years.

The Fisher Ohio Body Co. has found that the \$6,000,000 new plant, in which it commenced production last September, is not large enough to accommodate its business and has taken a lease on the building of the Briggs Manufacturing Co., which is adjacent to its main plant. This acquisition will give an additional 175,000 square feet of space, which will be used to house the finishing business. E. E. Fisher, president of the Cleveland company, states that the entire production is now going to the Chandler, Cleveland and Chevrolet companies.

When the new Fisher plant was opened in this city, it was thought that the 850,000 square feet of manufacturing space was far in excess of the requirements, but seven months after it is running at capacity production and is turning out from 250 to 275 bodies daily.

Standard Parts Report

The annual statement of the Standard Parts Co., which has been in the hands of a receiver for nearly two years, shows that the company's net business in 1921 was \$7,233,033, which is one-third below the record for the previous year.

On this business the company produced a profit of \$316,380 before a heavy depreciation and inventory adjustments were made. During the year the company found it advisable to enter a depreciation of \$398,341 and inventory adjustments of \$204,348, leaving a net loss of \$286,409.

Notwithstanding the difficulties that were encountered, Receiver Frank Scott bettered the cash position of the company. This account rose from \$428,661 on Dec. 31, 1921, to \$613,881 on March 1 of the present year. The sum of \$4,931,920 was disbursed to Dec. 31, 1921, and of this amount there were two dividends to creditors totaling \$1,943,018.

In line with a general policy of retrenchment and the unification of the manufacturing end of the business, the plant of the Canton Forge Co. was sold for \$293,500. Remaining equipment and inventory not available for the American Axle plant was sold for \$59,000.

The receiver states that in the sixteen months of his administration he has finally reached the point where inventories reflect the true market value, while all obsolete material in the plants that are being operated has either been sold or marked down to scrap value. After adjustments the company's assets total \$15,134,467, exclusive of patents.

Akron Likes Trade Acceptance System

Tire Makers Will Continue and Expand It Despite Outside Adverse Criticism

AKRON, March 18—The trade acceptance system employed by Akron tire manufacturers in negotiating with banks for their credit has vindicated itself and will be continued and expanded, despite the outside criticism aimed at the system, according to William O'Neil, vice-president and general manager of the General Tire & Rubber Co., and president of the Ohio State Savings & Trust Co. of Akron.

Speaking of the situation, O'Neil says:—

The plan adopted by Akron bankers and manufacturers of extending credit on orders booked for manufactured merchandise—in other words the trade acceptance plan—has been widely criticised and condemned both in and outside of Akron and by both manufacturers and bankers. But the trade acceptance system has been so effectively employed here for years that it is largely responsible for what and where Akron is to-day as one of the manufacturing centers of the world.

Bankers Approve

Akron bankers and manufacturers unite in recommending the system to other cities and other industries. The trade acceptance system has many advantages. It has helped to bridge the tire manufacturers over the seasonal dull periods. It has averted periodical lay-offs of men. It has kept production on an even keel for the manufacturers in times when business was dull have had the banks back of them ready to pay the wages of their employees, to pay their shipping bills and their raw material bills, accepting as security therefore the orders booked by those companies from their dealers. It is a tremendous advantage for an Akron manufacturer who receives a bona fide order for, say, \$500,000 worth of tires and rubber goods, to take that paper to the bank and negotiate credit upon it sufficient to manufacture the goods ordered.

The success of this system has been reflected in mercantile lines and other business channels. It has benefited the merchant and it has likewise benefited the entire motoring public, for it has helped to reduce the cost of tire manufacture. In short, it has made possible the national, or rather the world-wide, business which Akron now is engaged in, for it has helped to stabilize local conditions.

Speaking both as a rubber manufacturer and as a banker, I firmly believe the trade acceptance system, if adopted in other cities, will help to similarly stabilize businesses and will work to the benefit of everyone. It is a system that is going to be continued in Akron, for we know what it has meant to us in the past and what it will mean to us in the future.

INDIA TARIFF INCREASED

WASHINGTON, March 18—Advices have been received by the Division of Foreign Tariffs of the Department of Commerce that a new schedule of import duties for British India became effective March 1. The new rates include an increase of from 20 to 30 per cent on motor vehicles which, under the In-

dian tariff laws, are classed as luxuries.

The general import duty was raised from 11 per cent to 15 per cent ad valorem. Railway material and machinery, etc., which heretofore had been dutiable at the low rate of 2½ per cent, in order to encourage the industrial development of British India, was advanced to 10 per cent ad valorem.

The import duty on lubricating oil was not changed. An excise duty of one anna per imperial gallon is levied upon all kerosene produced in India and Burma, while the custom on imported gasoline and motor spirits has advanced from 1½ to 2½ annas per imperial gallon.

Personnel of Zeder Begins Taking Shape

CLEVELAND, March 17—Although plans for the manufacture of the Zeder automobile by the Zeder Motor Co., in the plant of the Cleveland Tractor Co., in this city are largely in outline at present, it is believed the making of the car will start in the near future.

Tractors will continue to be made in the plant here in increased number as the demand this year is good.

The personnel of the organization is beginning to take shape. E. B. Wilson, former sales manager of the Willys Corp., is said to have been engaged to take charge of the merchandising end. R. T. Hodgkins, a vice-president of the Cleveland Tractor Co., is already planning the sales campaign, it is reported. J. O. Hahn former branch manager of the Studebaker in this city, is also to be a member of the organization.

One of the moves contemplated in financing the project is the doubling of the \$6,000,000 capital of the tractor company. This corporation owns 110 acres of land with a frontage of 1200 feet on Euclid avenue, also frontages on both sides of the Nickel Plate railroad, St. Clair avenue and a frontage on the New York Central railroad.

Arrangements Completed for Frontenac Location

INDIANAPOLIS, March 20—With the departure for the East of Allan A. Ryan, New York capitalist and chairman of the board of directors of the Frontenac Motor Car Co. of this city, reports were confirmed that arrangements were practically completed for the purchase of an extended factory site for the new car.

Ryan was accompanied by William N. Thompson, president and general manager of the Stutz Motor Car Co. of America, Inc., another member of the directorate of the Frontenac company, who, with Ryan, has been active in its organization.

BENZ STATIONARY ENGINES

NEW YORK, March 21—A dispatch from Frankfort-on-the-Main says that a section of the Benz automobile works in Mannheim are being transformed for the construction of stationary motors by a special company with 40,000,000 marks stock capital.

Weight Forms Basis for New York Fees

Supplants Horse Power — New Car Owners Had Been Paying Less Than Old

ALBANY, March 21—New legislation of chief importance to motorists in New York state is confined chiefly to the two bills increasing registration fees of both passenger cars and trucks. In licensing passenger cars the legislature, at the recommendation of the tax commission, abandoned the old-time method of horse-power as a taxation basis. For the first time in this state weight will determine the amount of the registration fees, the cost being rated at 50 cents per 100 pounds for cars weighing, fully equipped, 3,500 pounds or less and 75 cents per 100 pounds for cars over 3,500 pounds.

With the recent price changes the motor experts of the state discovered, somewhat to their surprise, that owners of new cars registered for the first time this year were paying a lower fee than owners of similar cars purchased a year or two ago. The new system increased the registry fee by 10 to 15 per cent over existing rates. The minimum fee, hereafter will be \$8. At present the minimum fee is \$5 for a four-cylinder vehicle. The new registry plan will not go into effect until Jan. 1, 1923.

Commercial Vehicle Rates Higher

Rates on motor commercial vehicles have also been increased, but, through the representations made to Senator Lowman and others by motor truck interests, the legislators admitted that the fees first proposed were excessive, and substantial reductions were made. Notwithstanding this, the new motor truck fee for all vehicles will be 60 per cent higher than at present, a very material increase.

The new system imposes a fee of \$8 per gross ton, making \$16 the minimum for two tons or less. The fee for such commercial vehicles is now \$10. The average 5-ton truck, which, when fully loaded, has a gross capacity of about 11-tons, will pay a fee of \$88 instead of \$55, as at present. These new motor truck fees will also go into effect on the first of next year.

No effort has been made to introduce a gasoline tax, which was hardly necessary in view of the fact that higher fees have been imposed all along the line on cars owned in this state.

CANADIAN OFFICE IN NEW YORK

OTTAWA, ONT., March 18—The office to be opened in New York by the Canadian Trade Commissioner there will be in operation on April 1. It is said that inquiries have been received with regard to prices of automobiles, trucks and accessories, and it is believed that a market can be secured for Canadian products.

Men of the Industry and What They Are Doing

Unwin Goes With National

Harry Unwin has been appointed sales manager of the National Motor Car & Vehicle Corp. at Indianapolis, succeeding James Clark who has become identified with a dealership organization. Unwin has been connected with the industry since 1901. He participated in laying out the route for the New York-to-Pittsburgh automobile endurance contest in 1903. During the war, when he held a commission as major in the Army, he superintended the construction of artillery tractors for war purposes at the Reo and Maxwell plants. He was the first secretary of the National Association of Automobile Manufacturers, later merged into the National Automobile Chamber of Commerce. Unwin has been connected with the Chicago branch of the Reo Motor Car Co. and before that was associated with agencies in New York for the Chalmers, Pierce-Arrow and the White.

Elgin Appoints K. T. Leech

K. T. Leech of Dallas, for a number of years engaged in the automobile business, both in wholesale and retail work, has been appointed a district sales supervisor for Earl Motors, Inc., his territory covering Oklahoma, Louisiana and Texas. About six months ago Leech retired from the business with which he had been associated for ten years and went to Germany to enter a new field of endeavor.

Sanders Will Retire

Frank H. Sanders, for eight years dealer in Franklin cars in the Chicago district, will sell out the business he has operated under the name of the Franklin Motor Car Co. and retire from the retail automobile field. When Sanders went to Chicago from Cincinnati the yearly business at the former dealership totaled 61 cars. In 1921 Chicago led the entire list of Franklin dealerships.

Davies Directs Service Work

R. G. Davies has been appointed field service director for the Ruggles Motor Truck Co., Ottawa, Ont., his territory including Ontario and Quebec. His duties will bring him into touch constantly with Ruggles truck owners, and by keeping the owners satisfied with the service rendered, it is expected that he will prove of material aid to the selling end of the business.

Morgana Joins Maxwell

Charles Morgana has tendered his resignation as vice-president and director of C. H. Wills & Co. to become superintendent of the Maxwell Motor Corp.'s Detroit plants. Morgana was with Wills and J. R. Lee in the Ford organization, and resigned with them to enter the Wills enterprise at Marysville.

ACTIVITIES OF EXECUTIVES

I. B. Derbyshire will succeed Harry Barrett as assistant treasurer of the Detroit Pressed Steel Co. in the near future, Barrett having tendered his resignation to enter the radiophone manufacturing field with a company which he is now organizing.

Captain William Sparks, president of the Sparks-Withington Co., is analyzing conditions in the Southern market for a few weeks, during which time he will make his headquarters at Daytona, Fla.

A. C. Andrews, vice-president of the Chase National Bank, has been elected a member of the executive committee of the American La France Fire Engine Co.

W. J. Rennick has been appointed secretary and treasurer of the McKone Tire & Rubber Co. at Millersburg, Ohio.

He was a specialist with Ford in the machine tool and engineering department, entering that company when it annexed the John R. Keim mills, Buffalo, in 1910.

Leahy, Durant Sales Manager

M. B. Leahy has been appointed general sales manager of passenger cars for all the Durant companies. He will be in charge of sales for the Long Island City, Lansing and Toronto plants. Leahy's first important position in the automotive industry was as New York branch manager for the Chevrolet Motor Co. He was promoted steadily until he became assistant general sales manager of Chevrolet under W. C. Sills. In this capacity he was in charge of sixty retail stores. When the Durant Motor Car Co. of New York was formed by W. C. Durant, he engaged Leahy as sales manager of that company and his promotion to general sales manager has followed in little more than a year.

Pfeffer in Engineering Company

Clarence A. Pfeffer, who was formerly president of the Saxon Motor Car Co., has formed a consulting engineering company under the corporate name of C. A. Pfeffer & Associates, which will specialize in financial problems within the industry. New York and Chicago men will be affiliated with Pfeffer in the new company, which will have offices in the Penobscot building, Detroit, and branch offices in New York and Chicago.

Mosher Leaves Covert

F. E. Mosher has resigned as vice-president and treasurer of the Covert Gear Co. of Lockport to become associated with the Dauch Chemical Co. of Louisville. Mosher is widely known in the industry, having been with the Covert Gear Co. for several years. His resignation is effective April 1.

Charles S. Turner Joins Hupp

Charles S. Turner, formerly of the Robertson-Cole Co., New York, has joined the Hupp Motor Car Co., as Far Eastern representative and is now preparing for a trip through this territory, which will take about 18 months' time. While with Robertson-Cole, Turner handled the Cole export interests in this field and is familiar with the business possibilities. There is much constructive work to be done by American manufacturers throughout the Far East before business can be restored to its former strength, Turner says. With the exception of India, he states, most of the countries are approaching a prosperous era and should present a good automobile market.

Vail Leaves Waltham Watch

E. L. Vail has resigned as sales manager of the automobile equipment division of the Waltham Watch Co., effective April 18. He has been connected in the automotive equipment field, where he is widely known, for many years. Prior to his activities in developing the market for Waltham clocks and speedometers, he was New England representative for the Splittorf Electrical Co. and later served as sales manager for the Hoffecker speedometer.

Hardy and Peasley on Tour

A. B. C. Hardy, president of Olds Motor Works, and Guy H. Peasley, sales manager, have been making a tour of the middle and far west, visiting distributors in those sections. They report that both dealers and distributors are unusually optimistic and that prospects for immediate and spring business are beyond their expectations. The distributor at Los Angeles, they report, has sent in an order for 250 cars and says he will need 400 more for March.

Allen Made Branch Manager

W. C. Allen, former manager of the Black & Decker Philadelphia branch and subsequently special representative, has been made branch manager of the company's Chicago territory. Allen has been a jobber's salesman, was connected with the Manley Manufacturing Co. as assistant sales manager and has been associated with the Black & Decker Manufacturing Co. for about three years.

New Overland Plan Has Willys' Favor

Replaces Bank Proposal—Stockholders Will Be Asked for Their Approval

(Continued from page 682)

fect arrangements with its own banks whereby the latter are to take \$16,500,000 in 7 per cent bonds maturing Dec. 1, 1923. These bonds are secured by fixed assets of the company in such a way that the current assets will be available for the normal operation of its expanding business.

All bank loans will be returned by these bonds, and inasmuch as the current liabilities of the company outside of bank loans are quite small in proportion to current assets the company will be left in a position to take care of operations at full capacity when conditions in the automobile industry will get back to normal.

While this financing provides for the company's needs and will have the effect of stabilizing the business for two seasons' operations, the bonds will be so drawn that they can be retired before they are due in order to make it possible for the company to refinance itself permanently at any time if it is deemed advisable to do so.

A considerable portion of fixed assets and properties can be disposed of during the life of these bonds, so that before maturity the issue should be considerably reduced in amount, thus facilitating the problem of permanent financing when conditions in the industry are propitious.

In view of the fact that the company owns a large amount in securities and properties which are not essential to the business as now conducted, and it is believed their properties can be converted into cash during the life of these bonds, it was felt by the directors of the company that this plan offered special advantages over any plan for long term financing at this time.

Loans Recently Extended

The banks recently extended for three months the \$16,500,000 loans which matured Dec. 1, but were extended to March 1.

Officers of the company are assembling data on assets unessential to the business which can be converted into cash. In this category will be several parcels of real estate in various parts of the country, some buildings and other tangible property which can be placed on the market now.

The Willys-Overland interest in the Moline Plow Co., it was asserted by officers, will not be offered for sale at the present time. These holdings amount to 82 per cent of the Moline common stock. **Has \$8,000,000 Cash**

Willys-Overland has \$8,000,000 in cash and it is believed no difficulty will be experienced in taking up a considerable portion of the bond issue before it matures. Retail sales which have been very good for several months, are reported to have been even better since the latest price reduction.

Leroy Peed, assistant sales manager, states that the Toledo branch will break its monthly record this month with the sale of more than 500 cars. Sales are

COMMERCE ADDING RADIOPHONE TO LINE

DETROIT, March 21—The Commerce Radiophone Co. has been formed as a subsidiary of the Commerce Motor Car Co. by Walter E. Parker, president, and other officers of the company. Production and deliveries have been started already.

The development of the radiophone as an auxiliary to automotive manufacture is regarded as one which may be taken up by other companies as a means of utilizing some of the present unoccupied factory space. The General Motors Corp. anticipates that some of the factory buildings it is offering for sale will be taken over by radiophone companies.

excellent throughout the Central and Eastern States.

Quarter Will Meet Early Predictions

(Continued from page 682)

sory end of the industry are exceedingly gratifying. Releases and new orders have been received in such large volume that many plants are approaching capacity production. Business booked ahead indicates that this condition will prevail for another two months at least.

Truck sales promise to expand steadily as the year progresses. This will be true particularly of light delivery wagons as the result of the unexpectedly early improvement of conditions in the agricultural districts.

Tire production also is increasing and there are reports from Akron of a prospective price increase in the near future. Even if there is no upward revision it is assured that there will be no further tire price reductions. Increasing cost of materials has counterbalanced the greater efficiency of labor and reduced operating expenses.

From a financial viewpoint, the annual reports of large companies in the industry demonstrate that all of them have taken their losses and are going ahead this year on a profit making basis in spite of keen competition.

AMERICAN-EGYPTIAN TRADE

LONDON, March 8 (by mail)—Official statistics show that Egypt imported 926 motor vehicles in 1921, valued at £471,568. More than 30 per cent of these came from the United States. Italy and France sent 25 and 20 per cent, respectively. During the same period gasoline to the value of \$1,889,181 was imported, chiefly from the United States, Rumania and Persia.

Court's Views Sought In Association Case

Hardwood Counsel to Make Petition—Hoover Calls Conference for April 12

WASHINGTON, March 22—A motion for a rehearing or modification of the United States Supreme Court's decree in the American Hardwood case will be made by L. C. Boyle, general counsel, this week. He will petition the court to state more definitely whether its judgment in the so-called open-competition case means absolute prohibition or inhibition on gathering industrial statistics and the distribution of these data to memberships of various trade organizations.

The court will also be requested to determine whether such activity is prohibitive only when used in connection with other factors of the trade association work which reflect agreement or understanding to fixed prices or curtailed production. The outcome of the Supreme Court action in this matter will be of utmost importance to all lines of industry.

The trade associations are manifestly uncertain as to methods of procedure in view of the Hardwood decision. Secretary of Commerce Hoover is cognizant of the situation, and as a consequence has called a meeting of various trade bodies in this city on April 12 for the purpose of discussing trade association work and devising lines of operation in accordance with the views of the Department of Justice and the Department of Commerce.

Boyle is of the opinion that the Court acted on an important statement of facts by the Government, and if a rehearing is granted he will endeavor to show that industry needs a more definite statement as to the line of cleavage in association work.

Motor Transportation Gains in Syria; Market Is Dull

WASHINGTON, March 22—Motor truck transportation has developed considerably of late in Syria, but at the present time the market is overstocked and business is depressed, according to reports received by the Automotive Division of the Department of Commerce.

Consul Knabenshire, at Beirut, reports that motor trucks, especially those with a capacity of 2 and 3-tons, have proved effective competitors to wheel carts and railways for transportation of both passengers and merchandise. With 250 trucks in operation in the Damascus district, business is improving.

The railway company there has met motor truck competition by the establishment of an automobile transportation service between Beirut and Damascus, a route of 69 miles; Beirut and Didon, 29 miles, and Beirut and Tripoli, 56 miles. The motor vehicles have been ordered from France.

Maxwell-Chalmers Report Is Presented

**Balance Sheet Shows \$19,731,000
Current Assets—Current
Liabilities \$6,278,000**

DETROIT, March 21—The consolidated balance sheet of Maxwell Motor Corp. and Chalmers Motor Corp. and their subsidiaries as of Dec. 31, 1921, shows a total of \$62,794,256 assets and liabilities. Total current assets are placed at \$19,731,658 and current liabilities at \$6,278,943.

Current assets show cash of \$2,895,284; bank acceptances, marketable securities etc., \$4,121,385; car shipments against B/L drafts, \$871,678; notes receivable, \$528,892; customers and dealers accounts, \$606,069; claims against the United States government, \$144,453; and inventories, at lowest cost, \$10,563,895.

Current liabilities are notes payable due June 1, 1922, amounting to \$3,849,795; accounts payable, \$1,841,309; accrued interest, taxes, etc., \$334,141; dealers' and distributors' deposits, \$253,697.

Permanent assets, shown as land, buildings, machinery and equipment, less depreciation, aggregate \$16,677,590. Other assets are listed at \$982,977. This latter item includes \$518,603, due from Maxwell Motors, Ltd., London. Good will is carried at \$25,030,296.

Gold notes of Maxwell Motor Corp. due June 1, 1923 and 1924, total \$3,172,171. Gold notes of Chalmers due Oct. 1, 1922, aggregate \$3,150,000; reserves for exchange, discounts, contingencies and for sales refunds, \$613,144. Capital stock totals \$44,579,996. This represents \$21,463 minority stockholders' interest in Chalmers; \$15,186,800, class A Maxwell and \$29,371,733, class B Maxwell.

Chalmers' Balance Sheet

The consolidated balance sheet of Chalmers Motor Corp. and subsidiaries shows total assets and liabilities of \$8,655,764. Current assets total \$3,420,529 and current liabilities, \$409,033. The assets include cash on hand, \$741,517; car shipments, \$36,997; bank acceptances, \$11,508; notes receivable, \$87,097; customer and dealer accounts, \$165,927, and inventories at lowest cost or market value, \$2,377,482.

Current liabilities are accounts payable, \$257,836; mortgages and land contracts, \$15,424; accrued interest and taxes, \$61,528; dealers' and distributors' deposits, \$74,244.

Permanent assets total \$4,950,811. Other assets, \$55,421; deferred assets, \$229,001. A claim against Maxwell Motor Co., Inc., is listed at \$1, pending determination of validity and amount.

Other liabilities are listed as: acquired by purchase of assets of Maxwell Motor Co., Inc., June 1, 1921, \$4,163,694; credits subsequent to June 1, 1921, \$196,739. First mortgage gold notes as shown in Maxwell consolidated statement, are \$3,-

150,000. Reserves total \$315,962. The amount of capital stock outstanding is 43,986 shares of preferred and 399,348 shares of common. A foot note declares the company "obligations for materials undelivered on Dec. 31, approximated \$1,000,000."

The attention of stockholders is directed by President William Robert Wilson to the substantial balances of cash and cash securities and the ratio of current assets to liabilities. He notes a further reduction of approximately \$6,000,000 in inventory since the last report.

"The corporation's new product, after a phenomenal reception, is finding an increasing acceptance and a more extensive dealer distribution," Wilson asserts. "Its quality and appearance have apparently marked it out among automobile buyers as an outstanding value, and your management has confidence that your corporations will enjoy during the coming year their share in the increased volume of business anticipated."

Receivers Are Appointed for Ward La France Truck

ELMIRA, N. Y., March 22—Oscar N. Reynolds and Alexander S. Diven of this city have been named receivers for the Ward LaFrance Truck Co. by Federal Judge John R. Hazel of Buffalo. Application for receivership was made by Leslie L. Zeet of Pittsburgh. The action will keep intact assets of the company, it is said, until bills can be paid.

The company claims assets of \$280,000 and liabilities of \$180,000. The business is being continued, and the receivers say that prospects for paying off all indebtedness are favorable.

Before the receivers were named, A. Ward LaFrance, president and general manager of the company, notified creditors that financial affairs of the company had reached a crisis and that some of the note holders had asked for the appointment of a receiver. He expressed the hope that someone would be able to come forward with a satisfactory reorganization plan.

NEW WACHUSETT TRUCK

FITCHBURG, MASS., March 18—The Wachusett 2½-ton truck, assembled from standard units for the New England market is a newcomer in the commercial field. The parts used include such names as Continental, Timken and Brown-Lipe. Officers of the Wachusett Motors, Inc., the assembler, are F. S. Suthergreen, president; W. C. Dresser, vice-president; F. H. Brown, treasurer, and R. H. Bingham, secretary.

ALLEN SALE DATES FIXED

COLUMBUS, March 17—Judge Sater in the Federal court has set April 18 for the sale at public auction of the assets of the Allen Motor Co. The property consists of plants at Columbus and Bucyrus and much material as well as some finished automobiles. The minimum upset price is fixed at \$500,000.

Negotiating to Buy Torbensen Axle Co.

**Cleveland Interests are Seeking
Controlling Interest in
Stock Republic Holds**

CLEVELAND, March 22—R. C. Enos, vice-president and general manager of the Torbensen Axle Co. stated to-day that Cleveland interests are negotiating for the company, and it is expected that purchase of the plant will be closed late this week.

The Republic Motor Truck Co. has owned all the \$750,000 common stock of the company since 1917, and the Cleveland interests propose to buy a controlling interest in this stock. It is understood that if the reorganization is effected there will be some new financing that will greatly strengthen the position of the axle company.

Enos denied a report that J. O. Eaton, formerly president of the Standard Parts Co. and later one of the receivers for that company, had been selected as president of the Torbensen company.

The \$2,500,000 funded debt of the Republic Truck Co. is secured by a first mortgage on all the fixed assets of the company and by pledge of the entire common stock of the Torbensen Axle Co. This fact has complicated somewhat the negotiations for purchase.

The Torbensen company was incorporated in Ohio in 1916 as a successor to the Torbensen Gear & Axle Co. It also controls the Powrlok Co., which manufactures differentials in Cleveland. The Torbensen plant here has an annual capacity of from 40,000 to 50,000 sets of axles.

Autocar Business Gains 25 Per Cent This Year

ARDMORE, PA., March 21—The Autocar Co.'s main factory here, has increased its working time three hours, to fifty hours a week, because of increased business. This brings additional returns to 1250 employees. One thousand other employees in branches also are working on the same basis.

David Ludlum, president of the company, states that business so far this year has increased 25 per cent. Activity in highway construction and building are reflected in orders for trucks.

MONOGRAPH ON CHINA READY

WASHINGTON, March 22 — Announcement was made at the Automotive Division, Bureau of Foreign and Domestic Commerce, that a monograph entitled "China; Automotive Conditions and the Good Roads Movement," by J. Morgan Clements, American Trade Commissioner, has been prepared and is ready for distribution to the trade upon application. It is pointed out that the increase in road-building in China is not sufficient to warrant heavy sales of motor cars and trucks in that country.

Illinois Will Test Experimental Road

Results in California Show Roads
Laid by Commission There
Are Failures

WASHINGTON, March 22—Final tests on an experimental road that has been built at Bates, Ill., by the Illinois Division of Highways with the co-operation of the Bureau of Public Roads, will be started on March 27. The road is two miles long and includes 63 different sections, representing as many different methods and kind of construction with various thicknesses of concrete, cement grout and asphalt filled brick, as well as asphaltic concretes and concrete filled with rolled stone bases.

Since the completion of the construction of the road in April of last year, a corps of engineers has been kept engaged making observations for the effect of temperature changes, static and repeated loads and subgrade conditions, thus collecting data which, when analyzed, will supplement the information necessary for the rational design of roads.

In the final tests a fleet of ten motor trucks, surplus material from the war department, will be driven over the pavement, loaded lightly at first, but increasing in weight as the tests progress until a maximum of 12,000 pound rear wheel load is reached. The results will show definitely the types of pavement which can be expected to support heavy traffic, as well as those which will not satisfy the heavy traffic requirements that may be expected in the next ten or twenty years.

Results in California

SAN FRANCISCO, March 18—The concrete highway test conducted at Pittsburg, Cal., has developed the following results, according to the California State Automobile Association:

The five-inch reinforced concrete slabs now being laid by the California Highway Commission were the first to disintegrate and fail during the test.

The steel reinforcement method does not appear to be of sufficient value to pay for the additional cost required. It appears clearly that on equal foundations thickness of slab is the only insurance of permanency.

Section "J", the Arizona section, showed but little evidence of failure. This section is the six-inch plain concrete section and most nearly approximates the recommendations made by the association in its recent investigation of the state highway system as the minimum thickness and type of pavement that should now be laid on main trunk lines by the state highway commission.

Between Nov. 9 of last year and the close of January of this year, marking the beginning and end of the test, the amount of traffic driven over the highway reached a total of 3,668,100, figured as equivalent to traffic for ten years on the ordinary state roads. Each of the thirteen different types of concrete roadway was subjected to the same test and, ex-

cept for the design of the pavement itself, under identical conditions. Of these thirteen sections, but three, two of the California Highway Commission which proved failures and the one known as the "Arizona standard" are in general use in the western part of the United States.

Four Models of Stoughton Truck Reduced in Price

STOUGHTON, WIS., March 20—The Stoughton Wagon Co. has made reductions ranging from \$205 to \$450 in the price of the chassis of the Stoughton truck. The new schedule follows:

	Old Price	New Price
Model F, 1-ton.....	\$1,995	\$1,790
Model B, 1½-ton.....	2,350	2,150
Model D, 2-ton.....	2,800	2,490
Model E, 3-ton.....	3,600	3,150

The price of the C Model ¾-ton remains unchanged at \$1,240. No list has been issued on bodies which the Stoughton company manufactures to order in any type and size desired by customers, according to specifications.

WICHITA TRUCKS LOWER

WICHITA FALLS, TEXAS, March 17—The Wichita Motors Co. has made a downward revision in the prices of its trucks as follows:

	Old Price	New Price
Model K—1-ton.....	\$2,000	\$1,875
Model M—2-ton.....	2,500	2,400
Model RX 3-ton.....	3,500	3,200
Model O—4-ton.....	3,900	3,500

Ogren Price Reductions Range from \$500 to \$700

MILWAUKEE, March 22—The Ogren Motor Car Co. announces price reductions ranging from \$500 to \$700. The list follows:

	Old Price	New Price
7-pass. Phaeton.....	\$4,350	\$3,850
4-pass. Roadster.....	4,250	3,750
5-pass. Sport Phaeton...	4,250	3,750
4-pass. Sport Roadster..	4,250	3,750
7-pass. Sport Phaeton...	4,350	3,850
4-pass. Coupe.....	5,200	4,500
7-pass. Sedan.....	5,500	4,800

YUBA TRACTOR REDUCED

SAN FRANCISCO, March 20—The Yuba Products Co. has announced reductions in the prices of its various models of tractors. The old and new prices are:

	Old Price	New Price
Model 12-20.....	\$2,600	\$2,400
Model 15-25.....	3,100	2,750
Model 25-40.....	4,650	4,250
Rodeblider, Yuba engine.	5,000	4,750
Rodeblider, Wisconsin engine.....	5,000	4,600
Model 20-35 oversize.....	4,185	3,900

FEDERAL CORP. ASSETS SOLD

BOSTON, March 22—The Liberty Spark Plug Corp. has purchased the assets of the Federal Corporation of Westfield, Mass., and also the patent rights and trade mark to manufacture and sell Liberty spark plugs.

Majority Creditors Accept Premier Plan

Refinancing Will Bring in \$500,000 New Money—Has
Backing of Bank

INDIANAPOLIS, March 23—Plans for the reorganization of the Premier Motor Corp. have been practically completed, but a detailed statement is withheld pending final decision regarding the management and additional directors. The plan has been accepted by 90 per cent of all creditors, including 75 per cent of the merchandising creditors.

The refinancing, it is understood, will bring in about \$500,000 in new money. It is reported that the plan has the backing of the Fletcher-American National Bank and the administrator of the estate of the late L. S. Skelton.

The reorganization plan is conditioned upon the transfer of all assets of the Premier Motor Corp. of Delaware to the Premier Motor Corp., which would be organized under the laws of Indiana with a capital of \$1,000,000 divided equally into preferred and common shares. The new capital which would be brought in would be sufficient to complete the present production schedule, thereby liquidating enough of the inventory to provide for the ultimate payment of merchandise obligations.

Automotive Equipment Makers Discuss Exports

CHICAGO, March 22—Following a luncheon given by the Association of Automotive Equipment Manufacturers to hear Gordon Lee, chief of the automotive division of the Bureau of Foreign and Domestic Commerce, it was announced that the association would take up the appointment of an export committee at its regular meeting on March 24 to co-operate with the Department of Commerce.

It developed during the luncheon and the discussion that attended Lee's remarks on the work of the bureau that several members of the association have had some rather troublesome experiences with export orders. These members did not know before the meeting how to obtain the information that the department is now ordering for them.

Previous to coming here, Lee visited St. Louis, addressing the Advertising Club there and conferring with executives of the automotive industry in that city.

FORM NEW TRUCK COMPANY

KENOSHA, WIS., March 23—William Martinson, formerly first vice-president of the Winther Motor Truck Co., and Charles T. Abbott, who formerly was secretary of the same company, have formed a new corporation to be known as Martinson Motors, Inc., to manufacture motor trucks. The capital of the new company is \$2,250,000.

Arkansas Bankers Discourage Buying

Regardless of Their Attitude,
However, Sales Have Shown
Steady Increase

LITTLE ROCK, March 18.—Arkansas bankers continue their strangle hold on the automobile business of the state and apparently it will take something stronger than a change of heart to loosen the purse strings of the strong boxes. There is plenty of money in the banks for almost any kind of a loan, with the one exception of motor cars and every possible discouragement is being placed in the path of the prospective purchaser of an automobile.

Automobile dealers are loaded down with prospective buyers—people who really want motor cars and while sales have increased since the first of the year, there is plenty of room for improvement before the industry gets back to anything like normal. Without the aid of banks, however, it is noted that sales have been showing a steady increase for several months.

Another element, also, has entered into the sale of new automobiles and that is the man with a car to trade in. He usually wants twice what the car will bring in the market and when shown what cars similar to his are bringing he invariably insists that those are old cars, while his is in good condition.

Little Rock dealers have tightened up on trading to a point where it is practically impossible for a buyer to get a high price for his old car. The dealers know what cars are selling for and govern their trades accordingly.

Ministry Decides to Sell British Airship Fleet

LONDON, March 7.—(By Mail)—The British Air Ministry has decided to hand over at once its fleet of airships to the Disposals Board, despite the announcement made last month at the air conference that a period extending up to June next would be allowed for an imperial air service to be organized with these airships as the nucleus of a fleet.

The plan for the formation of such a service has failed, for although the governments of India, Australia, South Africa and New Zealand were invited to co-operate, only Australia assented. On this account and for reasons of economy, the reprieve of the airships has been cancelled.

The airships in question are: R80, R33, R36, R37 (incomplete) and the ex-German Zeppelin L71; R36 is the only one fitted with a passenger car. In addition to the vessels themselves, there are stations, engines, fabric, gas bags, station equipment, spare parts and stores to be disposed of.

The Disposal Board will be free to decide how and when they shall handle

the airships; they may hold them for awhile in the hope that even now a corporation may be formed to fly them, or they may scrap the entire fleet and sell the material piecemeal. Alternatively they may sell them to a foreign power, and in this connection it is reported that an emissary is on his way from the United States with the object of securing R33 or R36 for that country.

Business in Britain Is Feebly Fluctuating

LONDON, March 10 (by mail)—“Slow” and “Stop” are the prevailing speeds in the British motor industry. Demand for small cars and motorcycles is dead steady, while that for the large car is dead. Small orders have been obtained from Australia, Brazil and South Africa. Owing to stagnation, manufacturers find it difficult to retain skilled workers, and in some cases the latter are being paid for doing nothing in order to prevent them obtaining employment elsewhere.

It is thought that potential buyers are waiting for the present quarter to elapse in order to evade taxation. Company reconstruction is in the air, but is being deferred because conditions do not appear to justify fresh issues. Sir William Letts of Crossleys and other motor concerns, who has just returned from America, thinks it will be eighteen months before trade revives.

DORT PRODUCTION GAINING

DETROIT, March 20.—Dort production in 1922 is showing steady gains as the season progresses, according to an analysis of sales by President J. Dallas Dort. January tripled the output of the same month in 1921, and February more than doubled January. Orders for March delivery will exceed February by more than 200 per cent, he says.

1400 “INDIANS” BY APRIL 1

BOSTON, March 22.—According to a director of the Hendee Manufacturing Co. orders have been issued to speed up operations at the plant so that a production of 1400 motorcycles can be reached in April. The company soon will announce a new selling policy whereby machines may be paid for on installments.

MACK MAKERS CHANGE NAME

NEW YORK, March 22.—Stockholders of the International Motor Truck Co. at their annual meeting here to-day decided to change the name of the company to Mack Trucks, Inc. All the directors of the company were re-elected. No other business was transacted.

W. E. MCCREA DEAD

ROCK ISLAND, ILL.—W. E. McCrea, for 20 years general manager of the Moline Wagon Works and vice-president and sales manager of the plant after it was taken over by Deere & Co., died at his home in South Pasadena. He had resided the last nine years with a sister there. He was 63 years old.

Banks Favor Trucks But Deprecate Cars

Speaker at Credit Meeting Says
Financing “Pleasure” Vehicles
Is Poor Business

CHICAGO, March 17.—The Central Automobile Credit Association at its meeting here listened to an address by Charles W. Folds of Hathaway, Smith, Folds & Co.

Folds spoke on the necessity of presenting to the bankers a more convincing argument for financing automobile sales. He said that there was a wide spread conviction on the part of the bankers that the financing of automobile purchases was a more or less hazardous business and that furthermore the operation of the financing companies had a tendency to encourage extravagance and was contrary to the thrift ideas which the bankers were so anxious to establish in the minds of the public.

Cites New York Banker

The speaker said that he recently addressed the Robert Morris Association at Indianapolis, and one of the speakers on that occasion was an official of the National City Bank of New York. This banker was asked if the business of financing automobiles was a good business and he replied that the financing of trucks might be considered good but the financing of “pleasure” cars could not be considered good banking.

This remark created some amusement on the part of the diners, but a guest, a banker of Argo, Ill., asked permission to be heard and he expressed very frankly the opinion of the New York banker. He said that it was the purpose of bankers to inculcate ideas of thrift to be manifested in savings bank deposits. He asserted that the financing companies were encouraging extravagance by financing purchases of cars for men who could not afford either to buy or to maintain them after they were bought. He admitted the validity of utility sales but said exactly the same thing which the speaker referred to at Indianapolis emphasized, namely, that his bank would encourage the purchase of a motor truck or a tractor while at the same time deprecating the purchase of an automobile. Speaker Not Convinced

Much of the rest of the meeting was devoted to members of the association trying to convince this banker that the purchase of an automobile was really promoting habits of thrift on the part of the car purchaser, and that the use of the automobile for recreation and business was well worth the money that was invested in it. However, they made very little progress and those present regarded Franklin's opinion as indicative of the tendency of a good many bankers.

Folds called attention to the fact that because of an arbitrary ruling at Washington the paper of the automobile financing companies is not regarded as discountable at Federal reserve banks.

FINANCIAL NOTES

Eisemann Magneto Corp. reports net sales for the year ended Dec. 31, 1921, of \$646,775 and a gross manufacturing profit of \$84,758. The total income was \$87,516, the net loss \$201,635 and deficit after dividends \$175,380. Unfilled orders as of Jan. 1, 1922, eliminating doubtful accounts, were 42,968 magnetos for 68 customers, approximating \$1,500,000 in value. A new line of production is in process of development. The comparative balance sheet shows cash on hand Dec. 31, 1921, of \$39,086, as against \$298,530 at the commencement of operations on June 30, 1919; accounts receivable, \$190,316, compared with \$391,212 on the latter date and inventory of \$1,879,698 Dec. 31, 1921, contrasted with \$1,140,730 in 1919. The notes payable aggregated \$300,000 at the conclusion of last year's trading, compared with nothing on the 1919 date, and accounts payable in 1921 of \$65,960, as against \$22,024 June 30, 1919.

J. I. Case Threshing Machine Co. ended the year 1921 in a strong position despite the adversities with which it had to contend in its line of industry. The net result of operations was a loss of \$583,431 but this was due in large part to an inventory adjustment which caused a loss of \$2,788,458. The company had a comfortable working capital at the close of the year although cash on hand had shrunk considerably. Total current assets amounted to \$21,411,013, against which stood current liabilities of \$6,456,221, leaving a working capital of \$14,954,792. Current assets amounted to about three and a third times current liabilities. The total surplus was reduced by the year's loss of \$583,431, \$910,000 preferred dividends and a special contingent reserve of \$700,000, leaving as of Dec. 31, 1921, a surplus of \$1,622,491.

Packard Motor Car Co. reports that there are 3844 holders of preferred stock of the company and 1698 holders of the common stock. The outstanding shares of preferred stock total 147,818 and those of common stock 1,888,314. The widening of distribution of ownership is indicated by the fact that nearly 56 per cent of the preferred stock is in the hands of small holders, those owning less than 100 shares. These investors number 3658 or about 95 per cent of the total number of preferred stockholders. Only 13 per cent of the outstanding shares of this class is held by owners, or more than 1000 shares each. The highest amount in the hands of any individual is 3215 shares, or about 2 per cent. Out of the 1698 holders of common stock 1332, or about 78 per cent, own less than 100 shares each.

Chandler Motor Car Co. since Jan. 1, 1922, paid off all current trade obligations as of Dec. 31, \$420,000 dividends payable Jan. 1 and had reduced bank loans \$500,000, or 40 per cent. Based on this, 57 per cent of current liabilities at the beginning of the year had been met in the last two and one-half months. January and February shipments are reported to be 1600 cars, compared with 692 in 1921. The company expects to approach 2000 car shipments in March and to maintain this rate throughout the second quarter.

Martin-Parry Corp. reports for 1921 net income, after charges, inventory, adjustments and Federal taxes, of \$820, against a net income of \$311,345, or \$3.11 a share earned on the 100,000 shares of its no par capital stock in 1920. After payment of dividends there was a deficit of \$200,820 against a surplus of \$111,354 in 1920. The company's cash, according to the balance sheet, was \$98,732, in contrast to \$98,422 in 1920, and its accounts receivable were \$174,454, against \$133,509, while the notes receivable were

\$48,455 in contrast to \$38,992. Accounts payable increased from \$74,962 to \$114,099. The company borrowed \$150,000 on notes.

Wright Aeronautical Corp. for the year ended Dec. 31, 1921, reports net income, after charges and Federal taxes, of \$597,555, equivalent to \$2.66 a share earned on the 224,390 shares of no par value common stock. This compares with net profits of \$411,349, or \$1.83 a share, in the previous year. The net sales in 1921 were \$2,426,187 compared with \$1,486,124 in 1920. The operating income was \$458,488 in the year first mentioned and \$140,116 in the last named year. The surplus at the close of the year's business in 1921 was \$485,360 against \$411,349 in 1920.

Carlisle Tire Corp. announces that it is offering \$200,000 in notes exclusively to stockholders. They are payable one year from April 1 next with 8 per cent interest, payable semi-annually. The proceeds of the notes will be devoted to increased operations and material investments. The company contends that it is the part of wisdom to buy materials at this time, when the market prices are low.

General Motors Corp. directors will meet next week to take action on dividends. Payments will be ordered on the preferred and debenture stock, but the common will again be passed.

Lansing Plant Surveyed
for "Star" Possibilities

DETROIT, March 22—Complete details of the equipment at the Durant Lansing plant have been forwarded to Durant engineers in New York by Carroll Downs, vice-president of the Durant Michigan Co., with a view to ascertaining the possibilities of the plant for the manufacture of the new Star car in large quantities.

According to statements accredited to Downs in Lansing, the plant probably will supply the territory between the Alleghenies and the Rockies with the Star and will get into limited production by June 1. By the end of the year it is expected to reach a 200 a day schedule.

Downs was in Lansing accompanied by Edward Ver Linden, general manager of the plant, and M. B. Leahy, general sales manager for the Durant organization.

Contracts for the supply of units for the new car are practically signed, according to one of the leading unit makers, and will be official within a short time. Preparations for the manufacture of the parts are in most cases complete, and as soon as the Durant factories are ready to receive them, deliveries will begin.

Dealers from All Sections
Wish to Handle New "Star"

NEW YORK, March 22—Several hundred applications from dealers in every section of the country to handle the new Star car have been received at the headquarters here of Durant Motors, Inc.

Detailed plans for the distribution of the Star have not been worked out, however, and no appointments will be made until that has been done. While no announcement has been made, it is understood that some new sales plan is likely to be adopted for the sale of the car which is designed to compete with Ford.

BANK CREDITS

Written exclusively for AUTOMOTIVE INDUSTRIES by the Guaranty Trust Co., second largest bank in America.

Call loan rates displayed an easier tendency last week and quotations ranged from 3 per cent to 4 per cent as compared with 3½ per cent to 5 per cent in the previous week. This is the lowest range since early in January, and it is doubtless due, in the main, to the accumulation of funds resulting from comparative inactivity in several lines of business.

Fixed date funds also showed signs of ease and toward the last of the week 60 and 90 day maturities were quoted at 4½ per cent, and four, five and six months' loans at 4½ per cent to 4¾ per cent as compared with a previous range of 4¾ per cent to 5 per cent for all maturities. The prime commercial paper rate remained unchanged at 4¾ per cent.

The Federal Reserve statement as of March 15, 1922, showed an increase of \$10,149,000 in gold reserves and \$7,437,000 in total reserves. Total bills on hand declined \$53,931,000, while total earning assets increased \$100,595,000. Total deposits increased \$133,408,000, while Federal Reserve notes in circulation showed a decline of \$8,841,000. The Federal Reserve ratio declined from 77.8 per cent to 75.6 per cent.

The statement of the New York institution showed the following decreases: \$35,027,000 in total reserves; \$9,884,000 in total bills on hand; \$100,753,000 in total earning assets. Deposits, on the other hand, increased \$74,019,000, while Federal Reserve notes in circulation declined \$1,779,000. The ratio of total reserves to deposit and Federal Reserve note liabilities combined decreased from 84.9 per cent to 78 per cent.

Last week the Federal Reserve Bank of Atlanta reduced its discount rate on all classes of paper from 5 per cent to 4½ per cent.

The Bureau of Labor Statistics index number for February showed a gain of more than 2 per cent in wholesale commodity prices, as compared with a recession of 7/10 of 1 per cent for January. The February gain marks the sharpest advance for any month since last August. The general price level now stands 51 per cent above the 1913 average, although it is 44.5 per cent below the peak reached in the spring of 1920.

The Treasury Department's recent offering of \$250,000,000 1-year 4½ per cent Certificates of Indebtedness dated March 15 was heavily oversubscribed.

G. M. DEALERS ORGANIZE

DETROIT, March 17—The General Motors Dealers Association has been formed in Milwaukee by dealers handling lines produced by General Motors units as a means of furthering their mutual interests and the interests of the corporation. The plan has met with the approval of company executives, and similar organizations in other cities are expected to follow the Milwaukee initiative.

INDUSTRIAL NOTES

Air Reduction Co. has purchased all assets, including patents and trade marks, of Davis-Bournonville Co., pioneer manufacturer of all lines of oxy-acetylene apparatus. The manufacturing and sales organizations of the latter company will be amalgamated with those of the Air Reduction Sales Co., which is the operating company for the Air Reduction Co. This will further enlarge the company's extensive business in oxygen, acetylene, carbide and all products used in the oxy-acetylene industry. The purchase was accomplished without public financing or bank loans.

General Spark Plug Co., St. Louis, has been incorporated for \$120,000, fully paid up, and expects to be in production in thirty days. T. W. Meloan is president of the company, B. C. Howard vice-president, W. H. Grant secretary and treasurer. These officers compose the directorate, together with E. J. Newton of Cleveland and Wells S. Murphy of Kendallville, Ind. J. M. McKernan is production manager.

Martin-Parry Corp. has completed negotiations for a five-year contract with the Edward Hine Lumber Co. of Chicago for lumber for Martin-Parry bodies. The contract also calls for the erection of two plants at Lumberton, Miss., one to be used as a special cutting-up plant of the lumber company and the other to be built by Martin-Parry for the finishing and assembling of its base and top units.

Alemite Lubricator Co. of Syracuse has been purchased by W. H. Smith of that city, who will operate the business on a larger scale than heretofore. The company plans the erection of a large installation rack and will provide fifteen minutes' service. Smith has been connected with the Alemite company in Colorado, New Mexico and Wyoming.

Atlas Asbestos Co., Norristown, Pa., has been organized with J. Carroll Johnston as president to specialize in brake lining and other asbestos textiles and packings. Johnston was associated for many years with the American Asbestos Co.

Braender Rubber & Tire Co. has elected the following directors: J. K. Watson, R. Trimble, C. A. Horton, C. A. Shreffler, H. Cross, R. P. Boyd, T. Gardner, J. T. Johnson, M. Damman, W. P. Braender and F. L. Braender.

Black & Decker Manufacturing Co. has moved its Cleveland office to 2030 East Twenty-second Street. Dan Paul, formerly manager of the Pittsburgh office, is in charge.

New Jersey Die Casting Co. has been formed at Irvington, N. J., with E. H. Kelley president, and has acquired the entire assets of the Die Casting Co. of New Jersey.

Taft-Peirce Manufacturing Co. announces the removal of its Detroit office to 2230 First National Bank Building. William Fairhurst is manager of the office.

Automobile Body Builders Association is now located in the Gotham National Bank Building, New York.

BEARING BUSINESS IMPROVED

PHILADELPHIA, March 21—Roller bearing manufacturers state that for the first time in a year and a half orders are being placed for future delivery. Equipment is being improved and new machinery ordered. Business in some cases has almost doubled in the last few months and covers a wide range of prod-

ucts. Sales indicate that factories are preparing for increased production in the immediate future, and the present points to a good year in this district.

Reserve of Gasoline
Near May, 1921, Mark

WASHINGTON, March 20—Stocks of gasoline jumped 119,000,000 gallons during January, giving a reserve of 705,700,000 gallons, according to statistics compiled by the Bureau of Mines. This reserve is 130,000,000 gallons more than for the corresponding date in 1921, and is rapidly approaching the 800,000,000 gallon peak set in May of that year. Present stocks are equivalent to a 50-day supply, based on the total daily average consumption for 1921.

The daily average production in January increased by 371,195 gallons over production for the preceding month. This, however, was about 240,000 gallons under the daily average production in January, 1921. The daily average consumption fell off in December by about 1,000,000 gallons.

Lubricating oil shows a daily average production of 2,397,000 gallons during January, this being 266,000 gallons less than the daily average for December, 1921. Stocks on hand were 245,000,000 gallons, an increase of 28,465,000 gallons over the month previous.

Advice Given Tractor
Makers on African Trade

WASHINGTON, March 22—American tractor exporters are advised to obtain co-operation of merchants as a preliminary to developing interest among farmers when seeking a market in Africa. The Department of Commerce has received communications from agents in South Africa, stating that the tractor market is largely in the hands of American exporters, and this is due principally to American enterprise and sales methods.

According to British competitors, successful development of these markets depends upon the tractor deals.

Machine Tool Makers
Join in Big Merger

PHILADELPHIA, March 23—Officers of the Hilles & Jones Co. of Wilmington, Del., manufacturer of machine tools, announced to-day that the leading machine tool manufacturing plants of the country had been merged under the name of the American Machine Tool Corp. The capital is to be predicated upon the size and holdings of the plants to be merged, and will run into hundreds of millions of dollars.

The companies going into the consolidation are Hilles & Jones, Betts Machine Co., Rochester, N. Y.; Colburn Machine Tool Co., Cleveland; Newton Machine Tool Works, Philadelphia; Modern Tool Co., Erie, Pa.; Carlton Machine Tool Co., Cincinnati; Lodge & Shipley Machine Tool Co., Cincinnati, and Dale Machinery Co., New York City.

METAL MARKETS

AS a means of quickening orders and specifications at the old prices, the recent advance in steel bar quotations by certain of the independent interests may be said to have been fairly successful. Quite a few consumers enjoyed protection on the 1.35@1.40c. quotation, Pittsburgh base, and when the 1.50c. price was announced by one of the independents (several others later following the former's example), these consumers made haste to safeguard themselves. In some instances contracts covering requirements until June 30 were closed at 1.40c. The market, however, is no more 1.50c. today than it was when Jones & Laughlin Steel Co. announced its unwillingness to book further steel bar orders at below that level.

Some mills are asking 1.50c., but there is no limit to the tonnages that can be placed at 1.40c. and, while there is no question that quotations of 1.25c. and 1.30c., which were freely heard a month ago, have disappeared, there is considerable blank space left in the order books of some of the rolling mills, and they are more than eager to build up a comfortable backlog. So far there has been no advance in cold-finished steel bars as the result of hot-rolled prices. Where tonnages are involved makers of cold-finished bars appear to be glad to name 1.80c.

There are sufficient orders in the market to support prevailing prices for most steel products. The demand, however, is not sufficient to warrant any advance in prices. The best that producers can and do hope for is a steady market, not a rising one. In the sheet market fairly active demand for ordinary sheets continues, but there has been a decided easing off in fresh inquiries for full-finished automobile sheets. Competition has turned even keener than in the past, and there have been rumors of isolated instances of sharp cutting of prices on black sheets.

Steel.—Automotive consumers are consistent buyers of both cold- and hot-rolled strip steel, orders of 500 tons being more plentiful than in a long time. As a result, the rate of operations of strip steel mills is constantly improving. The market for hot-rolled ranges from 1.30c., Pittsburgh, upward, while cold-rolled is quoted at 3.50c. The sheet bar market is more active and the general quotation is \$29, Pittsburgh or Youngstown. Bolt and nut interests report good demand from the automotive industries, with much shading of prices in evidence.

Aluminum.—Publication a few days ago of a report that the Committee of Ways and Means was ready to report the revised tariff bill in the near future has caused holders of aluminum to be more reserved. While opposed to any increase in the duty on aluminum, importers and dealers in foreign aluminum naturally will want to conserve their stocks if there is a possibility of a tariff providing much higher duties being rushed through Congress, a contingency which at least must be reckoned with. The market is steady.

Pig Iron.—Automotive foundries continue to buy conservatively, tonnages involved ranging from 50 to 500 tons. Blast furnaces still complain that market levels are below cost of production, but the probabilities are that early readjustment of freight rates on ore and of the price of that raw material itself will permit of a considerable saving in production costs.

Copper.—Some of the producers who have resumed operations are already back on a 50 per cent of normal basis. Automotive demand for copper and brass products is on the increase.

Calendar

SHOWS

April 8-16—New York, Second Annual Electric Automobile Show, Showroom of the New York Edison Co.

FOREIGN SHOWS

March, 1922—Santiago, Chili, Annual Automobile Show.

March 10-July 31—Tokio, Japan, Peace Exhibition.

April 16-23—Mexico City, Annual Automobile Show, Auspices of the Automotive Division of the American Chamber of Commerce.

April 22-May 1—Prague, Czechoslovakia, Fourteenth International Automobile Exhibition.

May—Shanghai, Exhibition of Road Building Material.

May, 1922—Quito, Ecuador, Agricultural Exposition, celebrating Centenary of Ecuador. Automotive Section.

May 1-15—The Hague, Automobile Show, also Airplanes and Motorboats. Secretary, Spul 185, The Hague.

May 6-21—Scheveningen, Automobile Show.

May 24-June 5—Barcelona, Spain, Automobile Show under Dealers' Direction.

May 28-June 5—Prague, Motor Show. Hotel de Ville.

July 1-24—London (Olympia), Aircraft Exhibition.

Sept. 1922—Rio de Janeiro, Brazil, Automobile exhibits in connection with the Brazilian Centenary Association Automobilista Brasileira.

Sept. 15-20—The Hague, Automobile Show.

September—Buenos Aires, Argentina, Annual Exhibition, Sociedad Rural Argentina.

Oct. 12-23—London (Olympia), International Commercial Vehicle Exhibition.

November—London (Olympia), Automobile Show.

Nov. 10-Dec. 19—Brussels, Automobile Show, Palais de la Cinquantenaire.

Nov. 29-Dec. 4—London (Olympia), Cycle and Motorcycle Show, British Cycle Motors, The Tower, Warwick Road, Coventry.

November—Buenos Aires, Argentina, Annual Exhibition, Automovil Club Argentino.

CONVENTIONS

April 20-22—Buffalo, N. Y., Sixth Annual Convention of the American Gear Manufacturers Association.

May 8-10—New York, National Association of Manufacturers.

May 10-12—Philadelphia, Ninth National Foreign Trade Convention of the National Foreign Trade Council.

May 16-18—Washington, D. C., Annual Meeting of the Chamber of Commerce of the United States.

June 11-15—Milwaukee, Annual International Convention of the Associated Advertising Clubs of the World.

June 19-24—Colorado Springs, Summer Meeting, Automotive Equipment Association.

June 26-July 1—Atlantic City, Twenty-fifth Annual Meeting of the American Society for Testing Materials, Chalfonte-Haddon Hall Hotel.

August 28-Sept. 2—Detroit, National Safety Congress.

Sept. 18-23, 1922—Rome, Italy, Second Annual Meeting of the International Chamber of Commerce.

S. A. E. MEETINGS

Detroit, Mar. 24, April 28, May 26.

June 20-24—White Sulphur Springs, W. Va., 1922 Summer meeting of Society of Automotive Engineers.

Good Organizations Behind Best Sellers

Interest in Chicago Is Centering on Less Than Dozen Lines

CHICAGO, March 21—The demand for cars in Chicago has centered upon less than a dozen lines. Those favored lines include all classes of cars and for them business is good. Sales are far in excess of those of a month ago, and inquiries and live prospects are in such large volume that the promise of satisfactory sales is held out indefinitely.

In these lines that are popular with the public, favor seems to have been established at the Chicago show. It is not accident that coincident with the best selling lines there should be hard working organizations behind them. Personality of the dealer, his reputation and the reputation of the products he represents, aided by price that seem exactly to fit are other features that are helping to move cars here.

There seems to be a stir in the truck market. Interest in buying is expressed but for the most part this interest has not developed many sales excepting in one line which has been selling almost up to record volume for three or four months. The reasons given for activity in this line is that the organization was kept together and always on the job and that the company was powerfully financed and thus enabled to go through months of financial drain when there were no sales.

Business prospects generally are reported much brighter than they were a year ago. That March sales will go far ahead of February there seems no doubt.

TEXAS TRADE HOLDS UP

DALLAS, March 21—There appears to be no general depression in the automo-

bile business in Texas for the first twenty days of March. Dallas dealers declare the business held its own and the good sales conditions brought about by the annual spring show are still being felt. They say the actual sales thus far this month are about as large as those for similar periods of January and February.

FLAT RATE FOR CHEVROLET

DETROIT, March 22—The Chevrolet Motor Co. is working out, through its Detroit retail branch, a flat rate system of service which is expected to be ready for general adoption by all Chevrolet dealers by early summer. Chevrolet branches are now installing the latest features of the new Chevrolet models, such as the hand emergency brake lever, for owners of former models, at a fixed low cost.

C. L. THURSTON DIES

NEW YORK, March 22—Clarence Luther Thurston, for six years export manager of the Earl Motor Car Co., is dead at his home on Riverside Drive. He was born in Omaha in 1880 and was a son of the late Senator John M. Thurston. He was graduated from Harvard in 1900. He was secretary of the American Legation in Buenos Aires for a year. Thurston was taken ill several months ago while traveling in Spain in the interests of his company. He returned to the United States in February.

TORBENSEN PARTS STATIONS

CLEVELAND, March 23—Announcement is made by the Torbensen Axle Co. that it is establishing a chain of parts service stations throughout the country to assure users of its axles of national distribution of service parts. Each main station will carry a complete line of axle parts for all models, so that parts can be sent to any point in its territory within 24 hours.

Employment Exceeds Mark Set in December

February Shows 89,647 on Payroll in 49 Plants Against 85,524 in January

WASHINGTON, March 20—Comparison of employment in 49 identical establishments in the automobile industry for January and February, according to the Bureau of Labor Statistics, shows that the number on the payroll in February increased 4.8 per cent over the preceding month and that the percentage of wages increased 58 per cent. Statistics for February showed that in the 49 reporting establishments 89,647 were on the payroll in February, as compared with 85,524 in January. The amount of the payroll in February was \$2,431,860, as against \$1,539,613 in January.

Distinct Gain This Year

Comparing February 1921 and February 1922 a distinct gain is shown this year. The number on the payroll in February 1920 increased 58.4 per cent and the amount of the payroll in 48 identical establishments increased 82.5 per cent. In February 1921, 48 establishments reported 58,536 employees and last month these same firms reported 92,746 on their payrolls. The payroll for February 1922 amounted to \$2,528,514, as against \$1,381,052 for the same period last year.

Statistics on changes in wage rates and per capita earnings, compiled by the Department of Labor for the automobile industry are reported as follows:

A wage rate decrease of 5 per cent was reported by one establishment, affecting 12 per cent of the force. More time was worked and the per capita earnings showed an increase of 50.7 per cent when January and February figures were compared, bringing the industry back to a little above the level of December after the slack work of January.

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More Definite Planning Needed In Market Study

Passenger car manufacturers are interested in market analysis, but plans frequently lack definite objective. Recent survey shows what is being done, and gives basis for evaluation of methods. Maximum use not obtained from much of data collected.

By Norman G. Shidle

AUTOMOBILE manufacturers are thoroughly awake to the necessity for market analysis. A study of sales possibilities is being carried on by manufacturers of cars in every price class. The work has been going on for so short a time, however, in a majority of cases that methods of procedure are in a primary state. Speaking generally, such work was not undertaken until an absolute necessity arose for it.

While there are varying opinions as regards the usefulness of certain types of market analysis data, very great interest in the general problem is being evinced in every plant. High executives are looking for data of any kind that bears upon the subject, and are scanning carefully whatever material they can obtain.

In a few cases a study of marketing problems was begun a little before such study became absolutely necessary. Some companies began it, as soon as the necessity first began to appear in concrete form a year and a half or two years ago. In most cases, however, serious work has been going on for only a few months, while in the case of one company it is just starting at the present time. These are the outstanding features of a personal survey just completed among representative passenger car companies.

There is no better time than the present at which

to take stock of methods and purposes; to evaluate the tendencies in the work which has been done and to determine the proper bases for such work, together with the best methods of procedure viewed from a practical standpoint.

It is unnecessary to point out the need for a study of markets and marketing costs. The necessities along this line have been emphasized frequently. Under present conditions the automobile business cannot hope to go forward successfully without a more accurate knowledge of individual market possibilities, a more accurate basis for the adjustment of quotas, a better possibility of predetermining the number of sales which may reasonably be expected and balancing more closely sales and production plans.

These facts are pretty well recognized by executives throughout the industry.

There is a strong indication, however, that much of the market analysis work in progress is being conducted without a sufficiently definite purpose. There has not been enough planning before the collection of data was begun. Frequently, the appearance of some data bearing upon marketing problems has aroused interest and led to the collection of more data along the same lines. A company has sometimes been sold a subscription to a statistical service without knowing beforehand just what use is going to be made of it.

The offering of the service suggests possible sales plans, rather than sales plans demanding the service.

Then, having subscribed to the service, an attempt has been made to find out just how it might be used to the best advantage. This seems to have occurred in a number of cases, the statistical service being of considerable value *per se*, but not being utilized to the fullest extent in correlation with other data bearing on the same problem. This is the natural result of a failure to lay out a broad and definite objective in the beginning. It amounts to trying to build the superstructure of a building before the foundation has been laid.

Sometimes this difficulty has even gone so far as the establishment of elaborate research and statistical departments, authorized to collect data of various kinds. In one instance such a department was operated for over a year and collected a vast amount of statistical data. Then the department was discontinued because none of the executives found practical use for most of the data gathered. A somewhat similar experience has occurred in one or two other instances. In each case the fault was not with the type of data gathered, but with the failure to determine beforehand what the function of the data was to be.

To solve the practical problems of the individual company, market study must be approached from two viewpoints:

1. A fundamental plan, including:
 - A. The definite purpose of the analysis.
 - a. A determination of the market for the given car which may reasonably be expected by territories for the next few years.
 - b. A correlation of these results with production, financing and administrative planning.
 - B. A list of all the factors bearing on this market.
 - C. The relative importance or relation between these factors as regards the market of reasonable expectancy for the given car.
 - D. A survey of sources of accurate and comprehensive data concerning each of the factors listed.
2. The immediate plan:
 - A. The practical problems that demand immediate solution; quotas of some kind must be set at once on some basis, etc.
 - B. Take immediate action on the basis of whatever data are already available, basing judgment as to the best present action, however, on the ultimate necessities of the fundamental plan.

Immediate action of some kind is necessary in most cases. The laying out of the basis of the fundamental plan, however, need consume only a few days of concentrated thinking on the part of a capable executive. This having been done, whatever immediate action is taken can be so built up that it will ultimately fit into the more comprehensive plan.

Having laid down the outlines of the broad plan, the sales executive can probably turn over to his research or statistical man the task of seeking out the available sources of information and of procuring the data necessary to fill in with concrete figures and facts the fundamental picture already drawn. If this is done, there is no waste effort. Data are sought for and collected with a definite aim in view. When it has been gathered, its function has been predetermined and it is automatically put to the use for which it was collected.

The answer to the problem under discussion will never be reduced to a mathematical exactness. That is obvious.

Data concerning certain economic and psychological factors affecting the problem can never be said to be mathematically exact. It is possible, however, by analyzing statistically the sources and information available to come much closer to accuracy than has been done in the past.

Moreover, the picture under discussion is a constantly changing one. Whatever formulæ are developed, whatever methods of procedure are determined upon must take into account the fact that the data to be used will be in a constant state of flux. It is not enough to get a picture of the situation at any given moment. The development of the automotive industry is a dynamic, not a static, factor.

There is much material concerning sales and marketing questions now being collected by the various passenger car companies. Some of these data concern general matters of territorial analysis, competition, etc. Some of it relates to conditions of individual distributors and dealers in the particular organization. Nearly all of these data is being used to some extent. But it may be seriously doubted as to whether or not maximum use is being made of it.

Each bit of information is being put to a good use in itself, but the relation between the various units does not always seem clear. The various units are not welded together to give a comprehensive picture.

Thus far this discussion has been based on the assumption that every company is seeking to know its market of reasonable expectancy and to produce cars on that basis. This is not always the case. In certain instances there is still a tendency to make production capacity the chief gage of what production shall be. This results very frequently, in times like the present, in a production somewhat larger than the rea-

sonable expectancy, with a consequent forcing of cars.

One company, for example, had its production department set the production schedule for 1922 without consulting the sales department. It is now up to the sales department to get rid of the production set. In such a case, it is obviously necessary to base distributors' quotas fundamentally upon this production schedule, regardless of the results of market analysis.

The chief necessity in most of the companies is for a more definite fundamental plan, a more comprehensive correlation of data, and a more detailed analysis of the factors involved in marketing studies.

The work of laying out in detail the outline plan should fall on the shoulders of the general sales manager or some other important executive. It should never be necessary for a research department to sell its ideas concerning market analysis to the general sales manager or other executives. The problems involved are more vital to the permanent growth of the individual firm than any others presented to-day. Careful study and analytical thought are necessary.

The present article has simply attempted to visualize the situation as it stands and to point out probable trends in development.

In following articles the establishment of quotas will be discussed in more detail. The practice of a number of representative passenger car plants will be cited and a general picture of what the industry is doing will be presented.

A DEFINITE marketing plan should determine what data are to be collected and what use is to be made of that data. In certain instances the practice has been just the reverse. The result is considerable waste effort.

The chief necessity in most companies is for a more definite fundamental plan, a more comprehensive correlation of data, and a more detailed analysis of the factors involved in marketing studies.

This article is the result of a personal survey of representative passenger car plants. Following articles will discuss current practice in detail.

A Good Example of Modern Engine Design

New model of Buda engine is designed for light commercial trucks and similar applications, but is of heavy duty type and similar in general design to other engines of the same make. Compression ratio is 4.35 to 1. Special attention is given to securing water circulation around the valves.

By J. Edward Schipper

THE Buda Company has added to its line a new engine, which is typical in general construction of other engines of the same series, except that it is a smaller model. It is a heavy-duty, high speed type designed for light commercial or other use where a four-cylinder, $3\frac{5}{8}$ by $5\frac{1}{8}$ in. engine is applicable.

The four L-head cylinders are cast in block, with the cylinder head and the upper and lower halves of the crankcase cast separately. The two crankcase castings are iron and are divided horizontally. The engines are designed for three-point suspension with the rear supporting arm cast integrally with the upper half of the crankcase and arranged for main frame support. The forward end of the engine is supported at the crank center by a trunnion bracket arranged to rest upon a drop cross-member of the frame.

An idea of the general characteristics of this engine may be gained from the fact that it is a rather high compression type for a heavy duty engine having a compression pressure of 94.7 lb. per sq. in. absolute, or 80 lb. gage. The compression ratio is 4.35 to 1. There has been no attempt, however, to make an extremely high speed engine of this model, but to give it the moderately high speed characteristics which are necessary in light commercial work. The weight of the piston and connecting rod assembly is 7 lb. $3\frac{1}{2}$ oz., the weight of the piston alone being 2 lb. 14 oz. The design has been worked out to be clean and dust-proof as well as accessible.

Cylinder Block

The cylinder block is provided with large water jacket space which is baffled so that the water is discharged directly beneath the valves and is designed to secure circulation around each valve. The spark plugs are located in the cylinder head, the threaded part of the spark plug in contact with the head being entirely surrounded by water. The water outlet on the cylinder head is fitted with a removable elbow which can be placed in four different positions. In fact, the entire engine has been laid out to be as universal as possible in its installation. One factor which may be mentioned from an accessibility standpoint is that the cylinder head is provided with a ledge projecting beyond the block which makes it possible to remove the head without damaging the gasket, and, at the same time, with a saving of considerable time. Lugs on each end of the cylinder and head are provided for breaking the joint in removing.

The grey iron pistons are fitted with concentric rings above the wrist pin and one wiper ring in the lower part of the skirt. The piston heads have cooling ribs to dissipate the heat and in manufacture the pistons are so

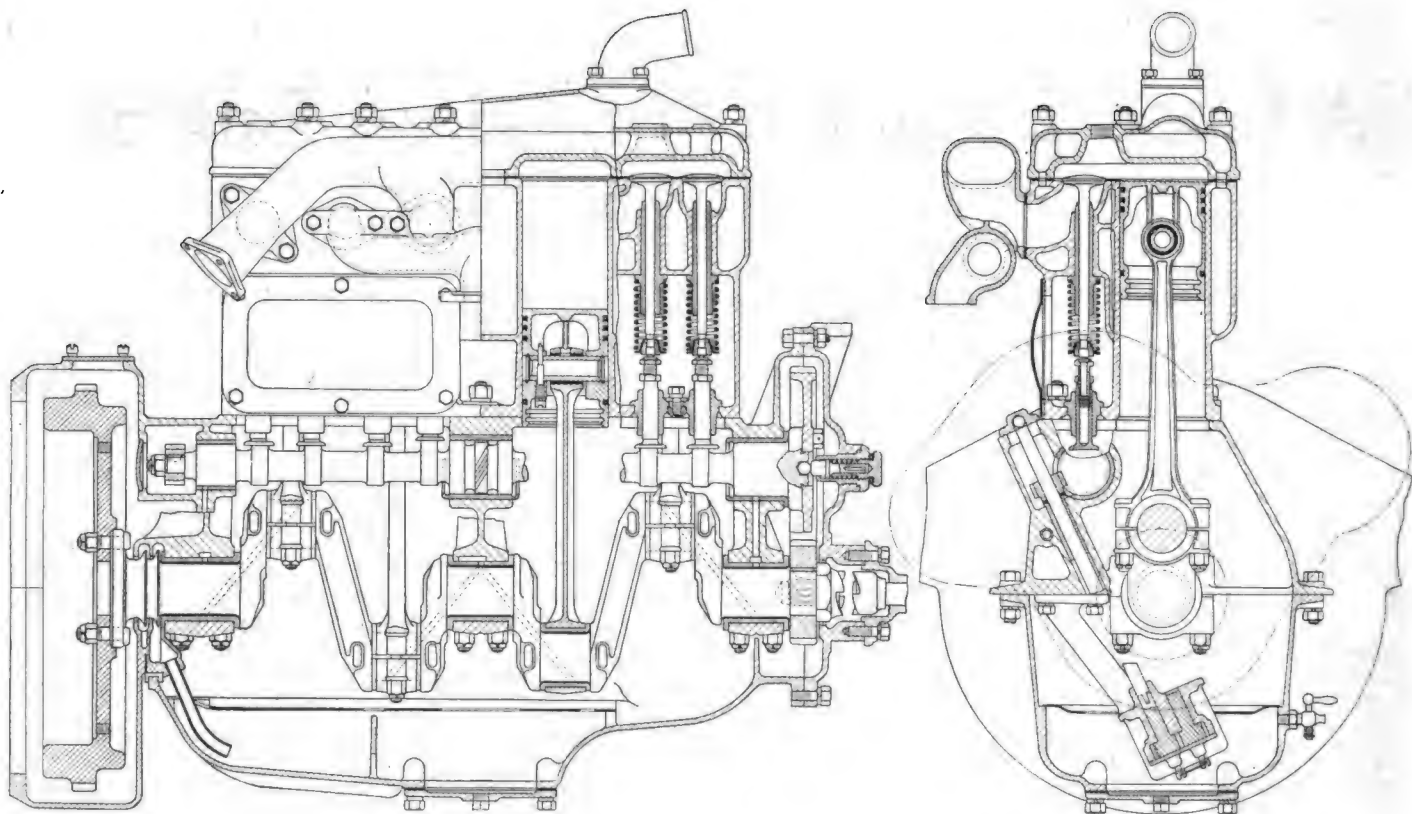
located in the reaming operation as to insure that the piston pin hole is square with the wall of the piston. A balancing pad is provided on each piston to permit the piston to be machined to a given weight and balance. The piston pins are $1\frac{1}{16}$ in. in diameter and have a bearing length of $1\frac{3}{8}$ in. The pistons are $4\frac{1}{2}$ in. long. To prevent the piston pin from working through against the cylinder barrel there are two locks on the piston pin, one being an alloy steel lock screw with two diameters and extending through both sides of the pin to give double shear and prevent improper fitting of the pin at any time. The second is a spring retainer ring which expands in grooves turned in each end of the piston bosses.

Crankshaft Construction

Drop-forged, I-beam connecting rods are used without offset. The upper ends are fitted with phosphor bronze bushings and the lower ends with bronze-shell bearings lined with babbitt. Two connecting rod bolts of alloy steel secure each bearing cap. The crankshaft is drop-forged from open hearth steel and is given a machine balance. Due to the heat treatment employed, the tensile strength of the crankshaft is upwards of 120,000 lb. per sq. in., and the elastic limit 85,000 lb. per sq. in. The rear end of the shaft is fitted with two oil throwers to prevent leakage at that point. The bearing dimensions, front to rear, are $1\frac{3}{4}$ by $2\frac{1}{2}$, 2 by $2\frac{1}{2}$ and $2\frac{1}{8}$ by 3 in. diameter and length. The connecting rod bearings are $1\frac{7}{8}$ by 2 in. diameter and length. The connecting rod length is $11\frac{1}{4}$ in. center to center.

Helical gears of wide face are used to drive the camshaft and auxiliary units. Special equipment has been installed in the Buda factory for the machining of these timing gears which are cut on automatic hobbing machines. Particular attention is paid to the gear centers in order to secure quietness. The timing gearsets include the crankshaft, camshaft, idler and pump shaft gears. Also, the generator shaft gear when the generator is used. This is optional with the purchaser. The gears are accessible upon removal of the timing gearcase cover at the front end of the engine.

The camshaft is a one-piece drop-forging of open hearth steel, machined and case hardened. The working surfaces of the cams and the three camshaft bearings are given a ground finish. The valves are driven through mushroom type pushrods which are fitted with removable guides. The pushrods are made large to permit the use of large diameter adjusting screws, as well as to maintain correct alignment. The heads of the adjusting screws are fitted with oil-hardened steel blocks to facilitate alignment and eliminate warpage caused by case hardening. The large



Part sectional views of new Buda engine

bearing area at this point also permits of low unit pressure at the adjustment and consequently minimizes wear. Single piece, interchangeable chromium steel valves are employed both for inlet and exhaust. The valves have an effective working diameter of $1\frac{1}{2}$ in. They are closed by barrel type, self-centering valve springs designed to eliminate side thrust upon the valve stems. The lower end of the valve spring and valve spring cup is held fast by a split type wedge grip valve spring retainer lock. This lock permits no movement up or down and is claimed to eliminate wear both on the lock and the groove in the end of the valve stem. To facilitate removal and permit adjustment of the valve tappets, the cover is split into two sections.

Cooling System

Pump water circulation is used, the centrifugal pump having a bronze runner and large packing glands. Bronze sleeves are fitted over the pump shaft to prevent rusting and pitting and the pump is made up as one assembly unit so that the water pump and its driveshaft can be removed as a unit or separately. The engine can also be arranged to use thermo-syphon circulation if desired. The fan is not furnished with the engine.

Full pressure feed lubrication provides oil for the crankshaft, camshaft bearings and connecting rod bearings. Oil is forced to the main bearings and camshaft bearings through a seamless steel distributing tube which is cast in the crankcase. From the main bearings the oil reaches the connecting rod bearings through passages drilled in the crankshaft. A pressure regulating valve is provided, the oil being pumped from the oil reservoir, which is located beneath the crankcase, by a geared pump located in the center of the oil reservoir and attached to the upper half of the crankcase to make it independent of the oil pan. The pistons and cylinders are lubricated by oil thrown from the lower ends of the connecting rods, while the timing gears are fed positively from the pressure system. The extra wiper ring on the lower end of the piston

is designed to prevent an excess of oil reaching the combustion chamber. There is a settling chamber for sediment in the bottom of the reservoir below the oil pump, from whence it can be drawn off from time to time.

The intake and exhaust manifolds are of grey iron cast integrally. Two types are provided, one giving a combination intake and exhaust manifold for gasoline and a special combination design provided for kerosene. The exhaust outlet is fitted with an expansion joint and the manifolds are placed on the valve side of the engine.

Regarding accessories, provision has been made for attaching starting and lighting equipment and for ignition by a magneto driven from the end of the water pump shaft or battery ignition by timer which can be mounted on the water pump driveshaft housing. A governor pedestal mounted behind the rear cylinder carries a vertical shaft driven by the camshaft. All of the accessories can be readily reached and detached. The engine complete weighs 646 lb. with flywheel.

New Oil-Proof Felt Washer

AN oil-proof washer for use on shafting protruding from machinery casings on automobiles, etc., has been perfected by the American Felt Co. It consists of two layers of felt with a layer of a patented compound between.

It is claimed that this laminated washer, after many months of tests in axle housings and other places, has proved to be an effective dam in stopping oil seepage and leakage, and has been used successfully in two other industries, the laundry and the bakery machine industries. In laundry machinery this washer is said to have proved an effective preventative against oil leaking into the vats, and in bakery machinery it prevents oil from leaking into flour and mixing vats. Oil leakage is very annoying, especially in connection with the rear axles, and it is to be hoped that this washer may prove the remedy for this trouble.

German Car of Novel Design Employs Many Aluminum Parts

Uses a six-cylinder, 2.44 by 5.51 in., aluminum alloy engine with thin steel liners cast in the block. The outstanding features are an automatic gear-shift, and rear axle housing casting and pistons of silumin. Although the chassis has a 137 in. wheel base it is said to weigh only 1870 pounds.

By Benno R. Dierfeld

THE Szawe, a high-powered, quality car built principally for export trade, is the product of the firm of Szabo & Wechselmann of Berlin. It was designed by Dr. Bergmann, a consulting engineer, formerly chief designer of the Bayerische Motoren-Werke and the N. A. G. It is claimed to be the first German car into the construction of which light alloys enter to a large extent.

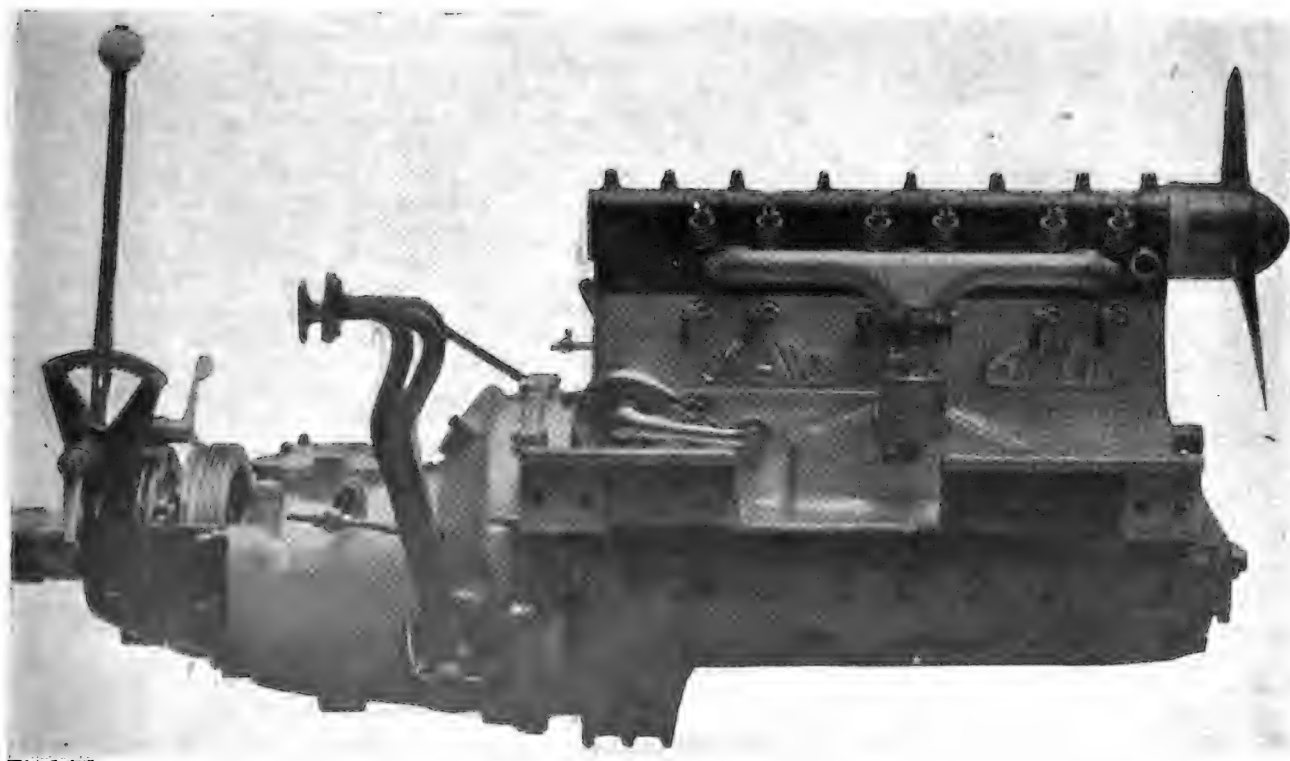
The chassis is laid out to meet fully the requirements of body builders. As will be seen from the views of the chassis, the side members of the frame are straight from end to end, there being no insweep at the front. All of the mechanical parts behind the dash lie beneath the top plane of the frame, so that there is a plane surface, bounded by straight lines, for the body builder to work on. The front springs are semi-elliptic, while the rear springs are of the cantilever type and of great length, which results in an unusual length of frame (110 in.) back of the dash.

The cylinders and top part of the crank case are cast as a unit in a block of silumin, an alloy of silicon and

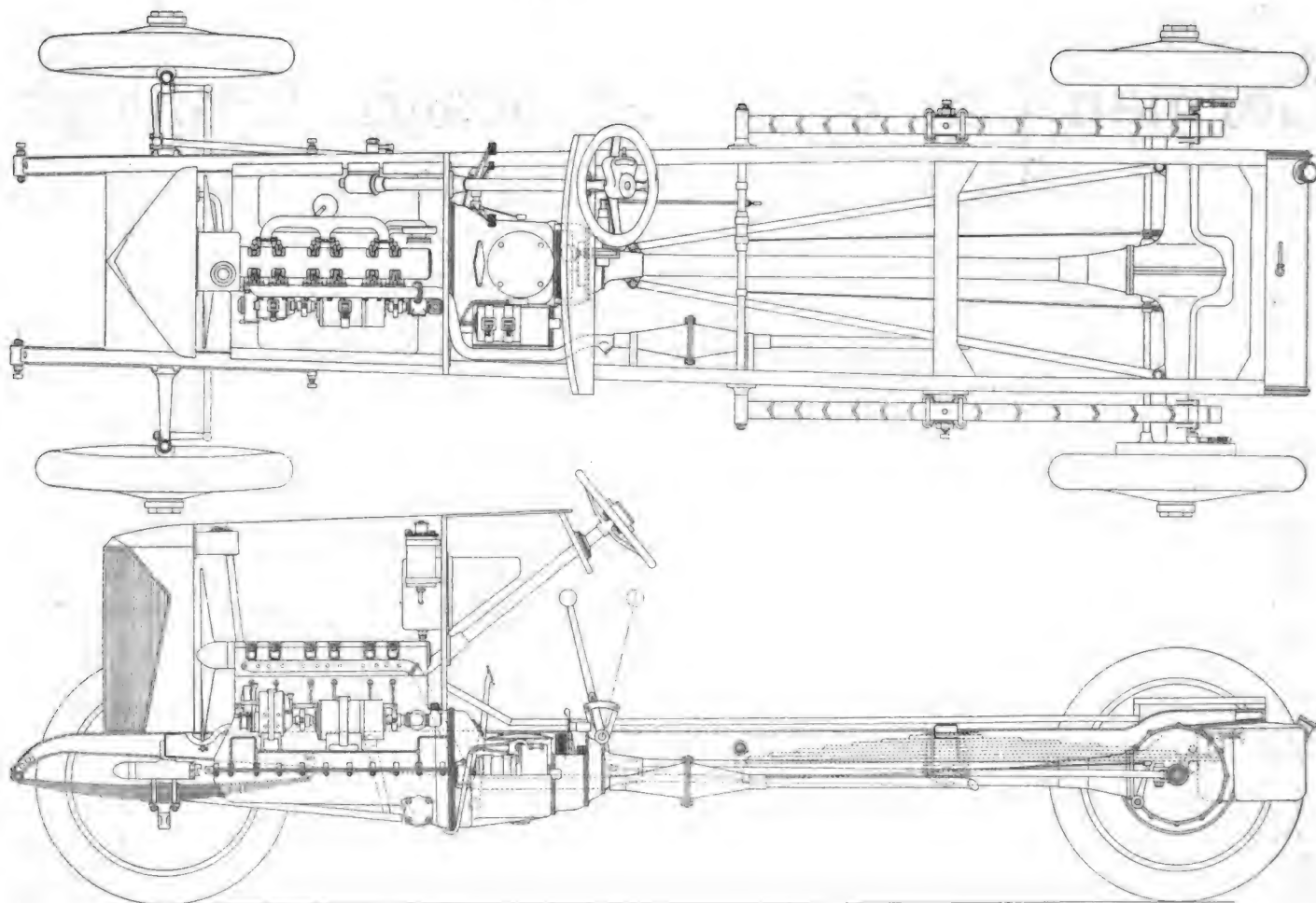
aluminum, with thin steel liners cast in the block. The bore is 62 mm. and the stroke 140 mm. (2.44 by 5.51 in.), the length of stroke thus being greater than twice the bore. It is claimed that at 2,400 r.p.m. the engine develops 50 hp.

An interesting feature of the engine is the patented piston, which is also of silumin. As may be seen from the sectional view of the engine, the combustion space is not surrounded by water-cooled walls, but is mainly in the hemispherical cavity of the piston head. At the moment of highest temperature, and therefore of maximum heat loss, the combustible gases are not in direct contact with water-cooled walls, and it is claimed that this results in a material increase in fuel economy. Overheating is prevented by the high heat conductivity of the silumin, the heat absorbed by the piston being conducted to the lower, cool part of the cylinder walls.

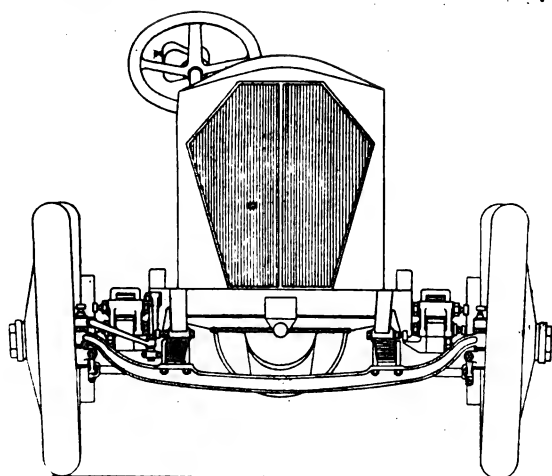
The upper end of the connecting rod is secured to the hollow piston pin, which has bronze bearings in the piston bosses. Lubrication of these bearings is effected



Powerplant used in Szawe car



Plan and side elevation of the new German Szawe chassis



Front view of Szawe chassis

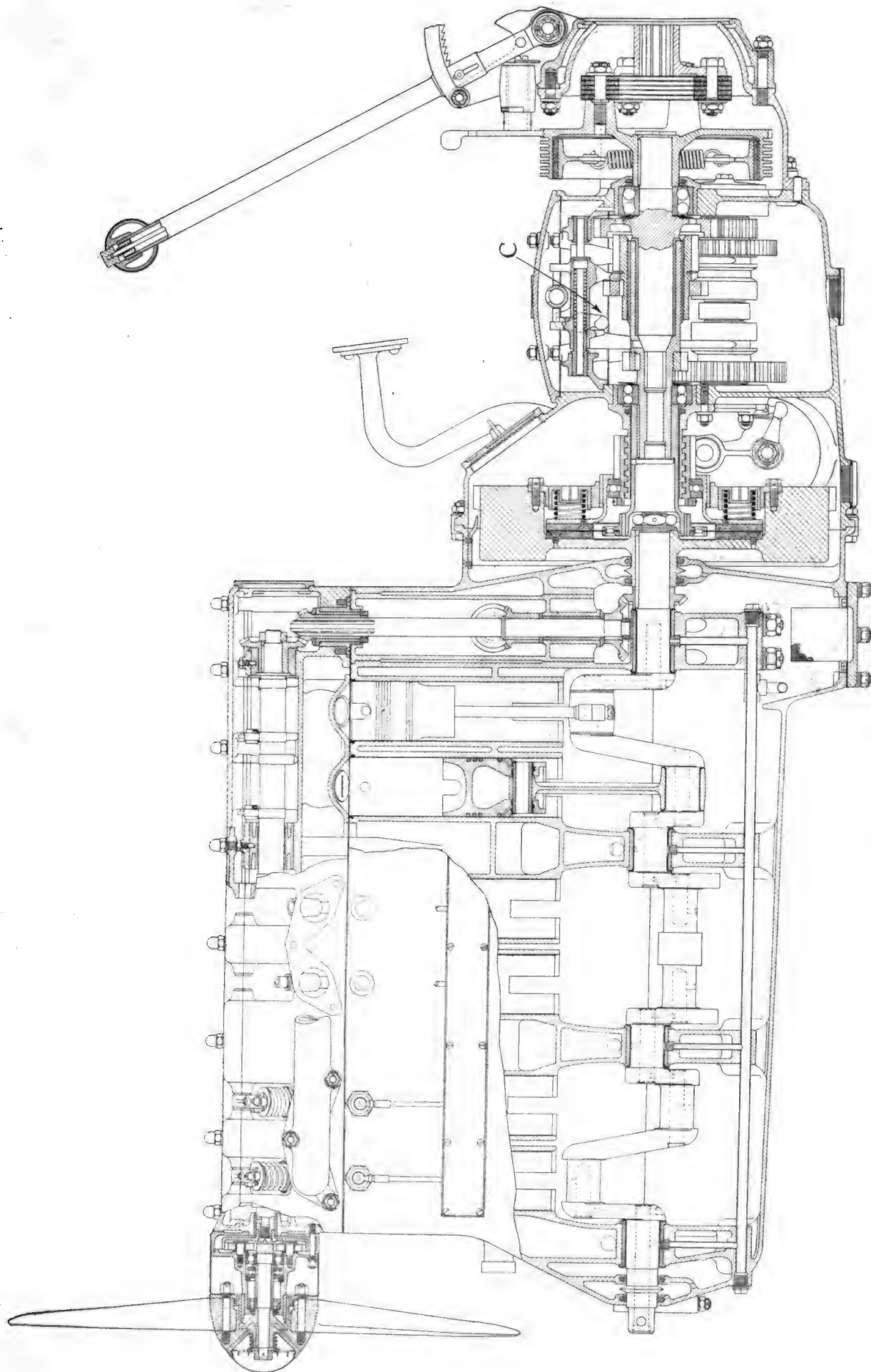
through inclined holes from an oil groove on the piston immediately below the lowest piston ring groove. The crankshaft is supported in four babbit bearings.

The valves are inclined toward each other at an angle of 60 deg. in the detachable cylinder head, and are operated by means of rocker levers from a common camshaft, which is driven from the crankshaft through a vertical shaft and bevel gears at the rear end of the engine. The camshaft drive is completely enclosed and arranged in such a manner that the timing is not disturbed when the cylinder head is taken off. The inclined position of the valves, together with the concave piston head, results in a substantially spherical combustion space, which makes for high thermal efficiency. The relatively long

piston stroke tends further to cut down the area of wall surface to which the hot gases are exposed during the early part of the power stroke, and thus to increase the thermal efficiency. Notwithstanding the long stroke, the engine is comparatively low, and no annoying vibration is experienced.

All parts of the lubricating system, including the piping, are arranged in the lower part of the crankcase. Lubrication is by what is known as the dry crankcase system, that is, there is no supply of oil in the crankcase. Similar systems are used on some aircraft engines. A four-part oil pump is fitted, to insure uniform supply of oil to all wearing parts without over lubrication of any one part. The oil pump is located in a depression in the bottom half of the crankcase and is driven through a worm gear. On the pump shaft there are three eccentrics, two of which operate a differential or stepped pistons, while the middle eccentric operates the piston valve for the pump. The main pump piston delivers oil under high pressure to all of the main bearings of the crankshaft. From the rear bearing the oil ascends through a cast-in copper tube to the cylinder head, flows through the hollow camshaft to the camshaft bearings and cams, and on its return to the oil pump inlet passes through the bearings of the vertical driving shaft. The crankpin bearings are lubricated through the hollow crankshaft.

If, while driving downhill for extended periods, a considerable amount of oil collects in the forward part of the crankcase, a second pump piston draws this oil back to the oil well in which the pump is located. A third, smaller pump piston draws oil from an oil tank located above the oil pump and delivers it to the engine system



Sectional view of the powerplant used in the new Szawe chassis. Note unusual construction employed to disengage clutch by use of coarse threaded rotating sleeve

to make up for oil consumed. The fourth piston serves to maintain the level in the oil sump where the pump is located, pumping all excess back to the oil tank. By this ingenious arrangement the engine gets only as much oil as is necessary for good service and over-oiling is prevented.

Continuous webs are formed between the crankcase arms, extending from the crankcase to the frame side members, thus rendering a sheet metal underpan unnecessary. The generator and magneto are located on the left side of the engine. These are driven by bevel gears from the vertical shaft. The water pump is located on the right side of the engine and is also driven by bevel gears from the vertical shaft. The fan is driven at twice crankshaft speed from the front end of the camshaft by an enclosed planetary drive. The rotary speed (4800 r.p.m.) and large fan diameter called for a special design. A two-bladed wood propeller of the same shape as an airplane propeller, with a paraboloidal hub to prevent air eddies, is used. The high position of the propeller results in a better utilization of the free space

9, 8 and the third gear through gears 7, 4, 10, 8. The fourth speed or direct drive is obtained by engaging pins 11 with holes 12. The reverse is through gears 5, 1, 2, 10, 8 and is obtained by an axial movement of gear 2 with the corresponding dog clutch. Gears 1 and 2 of the two secondary shafts mesh with each other, but gear 5 of the main shaft meshes only with gear 1. The number of gears is 10, the same as in the usual 4-speed gearset, but the secondary gears are distributed between two shafts and the transmission therefore is very short.

Every sliding gear can be shifted individually and is connected by a shifter fork with a shifter bar. The shifter bars are pressed by springs in the direction of engagement, but are ordinarily prevented from moving in that direction by a rotatable shifter cylinder resting against pins of the shifter bar. The cylinder has on its circumference axially offset holes into which only one shifter bar pin can enter at one time, according to the position of the cylinder. When the bar is in position the gear belonging to it is locked.

The shifter cylinder has on one end two projecting pins which are connected through a small worm and bevel gear mechanism and Bowden wires to the pointer and lever of the gear selector on the steering wheel, so that if the selector lever is turned, the shifter cylinder is turned also. The shifter cylinder can be turned only when none of the shifter bar pins are in the locking hole and when it is freed from the spring pressure, resting on the shifter bars. This is effected by connecting the clutch pedal with the camshaft C so that by pressing down on the clutch pedal this camshaft is rotated and all shifter bars are withdrawn at once. The rotation of camshaft C begins only when the clutch pedal is completely depressed.

The lever of the gear selector is not rigidly connected with the shifter cylinder, but first operates a spring device, which in turn rotates the shifter cylinder if it is free. Therefore, the effect of the gear selector is preparatory. A pointer on the gear selector informs the driver, which gear is momentarily engaged. Of course, this pointer is rigidly connected with the shifter cylinder.

Gearset Operation

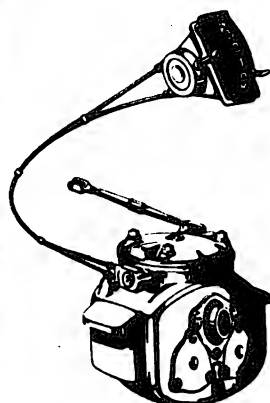
The operation of this gearset is very simple. If, for example, the second gear is engaged, the pointer of the gear selector on the steering wheel stands opposite the 2 on the dial. When the third gear is to be engaged, the lever of the gear selector is turned to 3, the pointer's position being unchanged. The change to the third gear is accomplished by depressing and reengaging the clutch, and can be effected at the most favorable moment, a long time after adjusting the lever of the gear selector, without taking the hands off the steering wheel. The pointer only shows the gear actually engaged. After having set the gear selector for a particular speed it is not necessary, for example, to engage that speed. When driving on second speed with the gear selector set for third speed, it is possible to turn the selector lever directly to the idle running position or to any other gear and then engage the corresponding gear by depressing and reengaging the clutch.

The starting motor is arranged on the left side of the gearset, driving through a spur pinion to the toothed rim of the flywheel. The transmission brake is pedal operated, and has internal shoes lined with asbestos fabric. On the outside of the brake drum there are cooling ribs, and a ratchet type sprag is fitted to the brake drum. Only one universal joint is provided, and that of the leather disk type.

The rear axle housing is of silumin. The rear wheel ball bearings run on steel tubes which are cast in the



Semi-automatic Szawe gearset



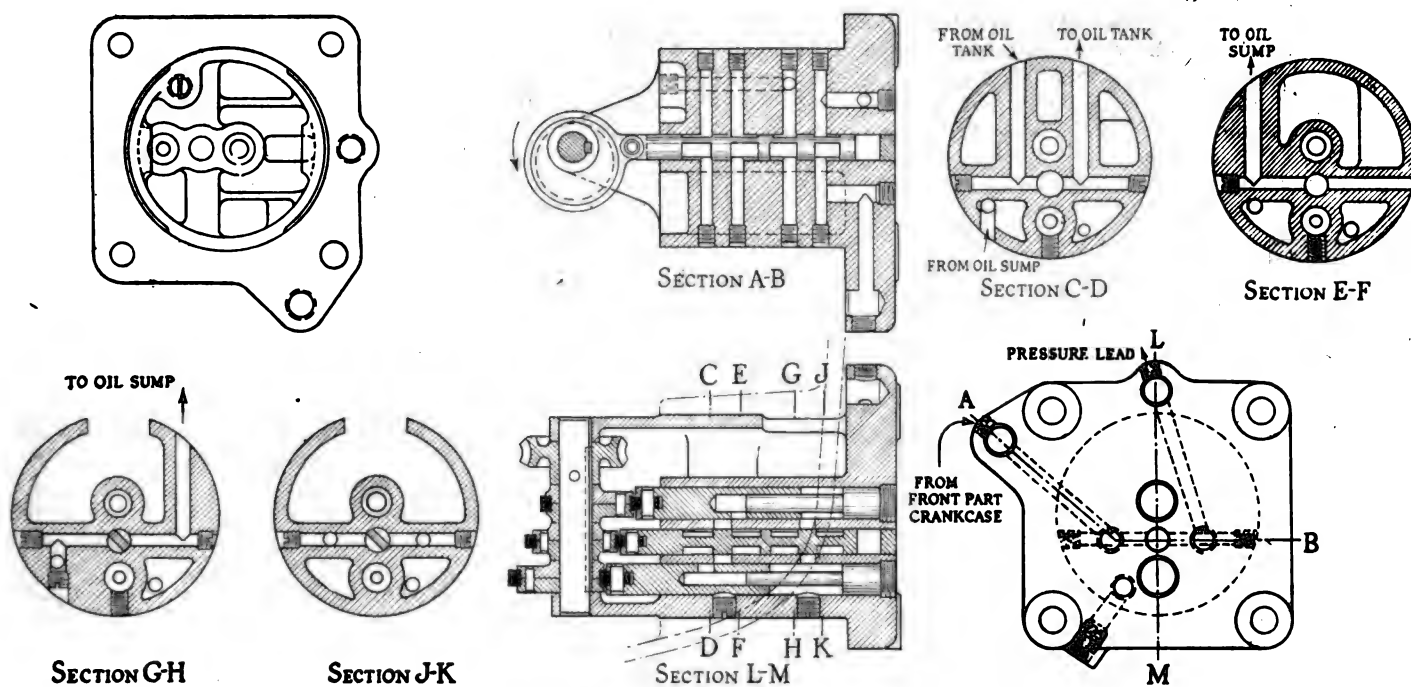
Bowden wire selector device

above the engine. In consequence of the good fan efficiency, the high pressure centrifugal pump, and the good heat conductivity of the cylinder and piston material, the compression ratio of the engine could be made unusually high.

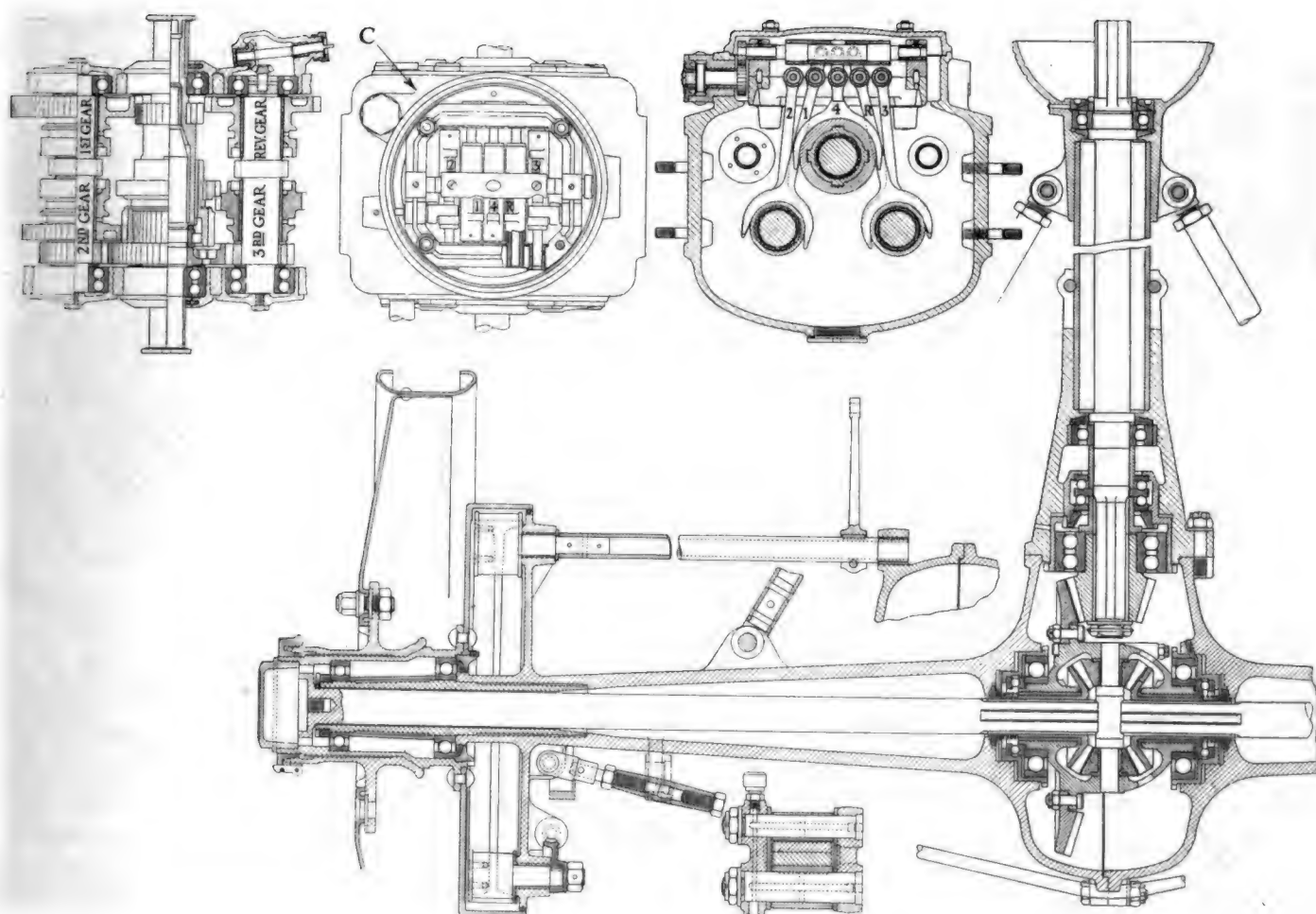
The carbureter is a vertical type Zenith. Air flows through the crankcase bearing walls around all bearings, and through cast passages to the carbureter. In abstracting heat from the bearings the air is slightly preheated, while at the same time the bearings are cooled.

The dry plate clutch has a driven plate of thin steel sheet of such a small mass that a clutch brake is not necessary. Six small springs produce the necessary pressure. The plates are lined with Ferodo-asbestos, interlaced with copper wire. No clutch release levers are used, their place being taken by a large screw, by which means back lash is avoided and smooth starting insured.

The gearset has four speeds and reverse, and is of entirely new design, the gears being shifted automatically and the gear lever dispensed with. The design is by Count Soden and the gearset is built by the Zahnrad-fabrik Friedrichshafen. A diagrammatic sketch of this interesting transmission is shown herewith. It has three shafts (main shaft above) and all gears are continually in mesh, change of gear being effected by means of dog clutches. Gears 1, 2, 3 and 4 are loose on their shafts but can be connected with them by dog clutches. All other gears are firmly secured to their shafts. The first speed is obtained through gears 5, 1, 9, 8, by engaging gear 1 with the corresponding dog clutch. In the same manner, the second speed is obtained through gears 6, 3,

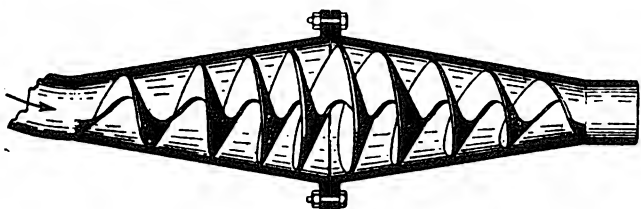


Sectional views of oil pump used on Szwed engine



Above, sectional views of gearset and, below, the rear axle with housing of aluminum

axle housing and form one piece with it. These tubes extend to a point beneath the rear spring seats, so that the principal bending moment is not imposed on the silumin housing. The rear axle thrust is transmitted by the propeller tube and two radius rods to a ball head at the rear of the gearset. The drive gears are of the spiral bevel type, and the differential is of the bevel gear type. The rear springs are cantilever type, the rear ends of which are carried between lubricated, ground, steel rollers, fastened to the axle case. Ball bearings are used throughout the rear axle. These bearings are not located directly in the silumin case, but in adjustable steel cages,



Novel type of muffler used on Szawe car.

so that the thrust bearings do not need to be specially adjusted by inserting steel disks, etc. The axle shafts are subject only to torsional stresses, and can be drawn out from the side. The rear wheel brake is an internal type with toggle mechanism. The steering gear is a screw and nut device of rather conventional design. The front wheels can be turned through the large angle of 40 deg. All joints are lubricated by grease cups, the

front wheel hubs run on ball bearings and the steel disk wheels are detachable.

A Pallas fuel feed device is placed on the dashboard. Fuel is delivered from the rear main tank to the carburetor through the front auxiliary tank. The front tank, of about 10 gal. capacity, is always filled, which is of importance in driving in mountainous districts where long upgrades may be encountered. From the auxiliary tank the fuel flows by gravity to the carburetor.

Szawe cars are fitted with the "Johest" muffler, a patented design that is said to be very efficacious. The sectional view of this muffler shows it to consist of a double cone shaped case, containing a sheet metal helix leaving a direct opening at the center. This helix varies in pitch and diameter from the ends toward the middle. The exhaust gases entering at one end flow partly through the central opening and partly through the helical passage. The larger part of the exhaust gases is subject to continuous expansion in the radial and axial directions, on account of the varying diameter and varying pitch of the helix. The result is said to be that the gases leave the muffler at a uniform pressure greatly expanded. This muffler is claimed not to give any detrimental back pressure to damp the noise and cannot be clogged.

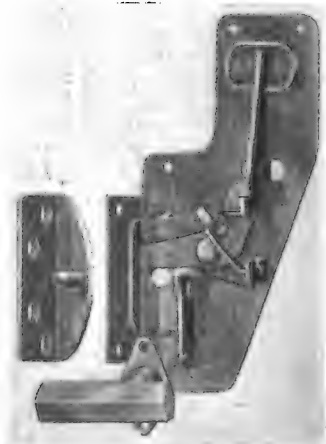
Following data relating to the Szawe chassis is of interest:

Wheel base	3,475 millimetres (137 in.)
Tread	1,400 millimetres (55 in.)
Tires (front and rear)....	880 x 120 millimetres (37 x 5)
Turning diameter	12 metres (40 ft.)
Seating capacity	6 persons incl. driver
Weight of chassis (without fuel)	850 kilograms (1,870 lbs.)
Speed	100 kilometres 1 hr (62.5 m.p.h.)

An Innovation in Door Locks

A NOVEL door lock is illustrated herewith, made by the Hooppaw Mfg. Co., who claim for it simplicity, durability and reliability. The lock comprises a keeper having a tapered, notched stud adapted to enter an opening in the lock body-plate. On the latter is a pivotal latch member adapted to engage the notched portion of the keeper stud when the door is closed. The latch member is operated to open the door either by pressing an inside push-button or by pulling an outside handle, requiring only a slight effort and only one motion in the natural direction of opening the door. The door is positively closed and securely locked without undue force or slamming. Another important advantage is that the keeper stud, entering the opening in the lock body-plate, guides the door into the closed position, and when interlocked with the latch member supports and securely holds the door in every direction. Cutting away or mortising of the door frame

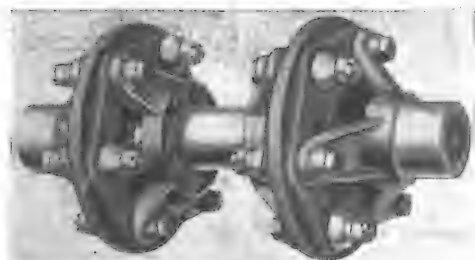
is minimized, and the lock body-plate serves as a gusset or reinforcement for the door and at the same time makes it unnecessary to use a supplemental block or frame member for supporting the lock. The locks are made in both right and left-hand models and are furnished with either the inside push-button or outside handle, or both, as may be desired.



Detail of Hooppaw door lock

Cord Disk Universal Joints

A FORM of flexible universal joint which embodies a different type of disk from that which has so far been in



Climax cord disk universal joints

common use has been developed by the Climax Motor Devices Co. In the Climax disk raised cord links extend from bolt to bolt, thus adding materially to the strength of the disk, it is claimed. The cords take the stress in direct tension. Only a single disk is used for each joint. Hemispherical bosses are formed at the bolt hole intersections, which are used as driving members. The metal spiders used in conjunction with the disks are formed to fit the disks on one side, and special cup-shaped washers are placed on the other side.

The manufacturer furnishes complete propeller shaft sets as well as double universal joint sets for insertion between the clutch and transmission.

The Pros and Cons of Various Types of Rear Axles for Trucks

A discussion of the advantages and disadvantages of the several types of construction in common use today, followed by an analysis of the stresses in axle shafts and the bearing loads which result under certain limiting conditions of torque and of forward and sidewise skidding of the truck.

By Ethelbert Favary*

THERE are five general types of final drive in use: (a) the chain and sprocket; (b) the bevel gear drive, with either straight or spiral gears, as mostly used on passenger cars; (c) the worm gear drive, which is now the most common type used on trucks; (d) the double reduction rear axle, in which two reductions are made between the propeller shaft and the rear axle; and (e) the internal gear drive, in which the first reduction is accomplished by bevel gears in the center of the axle, and the second by internal gears in drums or rings attached to the wheels.

Since bevel gears are not, as a rule, practicable for reductions in excess of about 6 to 1, their use on trucks, except on the smaller models, is ordinarily out of the question, for here the final reductions vary from about $6\frac{1}{2}$ to about 14, depending on the capacity of the motor truck and the truck speed.

The chain drive on trucks is used on about 4 per cent of the models manufactured. The chief objection to the use of chains is their exposure to dirt and grit, which in time causes excessive wear and noise. A number of attempts have been made to enclose the chains by covers of some kind, but they gave more or less trouble and were not entirely successful, for provision must be made in the cover for chain adjustment and for the relative lateral as well as the vertical movement of the sprocket centers on account of sidesway and spring flexure. Hence, to-day, most of the chain drives run with the chains exposed and by the employment of hardened chain rollers, pins, bushings and links the wear and the noise are minimized.

Advantages of Chain Drive

Lack of lubrication is by far the most common reason for noisy chains. It is claimed that applying lubricant with a brush to the chains each day, which takes only a few minutes, results in greatly decreased noise and wear, and that with proper care and treatment chains will run from 40,000 to 50,000 miles. This figure is considered far too high by users of chain driven trucks. The following are the principal advantages claimed for the chain drive over the other forms of final drive:

- (1) Simplest in construction.
- (2) Will stand as much or more abuse than any other type.
- (3) Average total efficiency, including the losses in the jackshaft, is as high or higher than that of any other form of drive.
- (4) Increased losses due to worn chain and sprockets are very slight.
- (5) Easiest form of final drive to repair, as repairs can usually be made on the road with spare links.

- (6) Bevel and differential gears are carried on the sprung portion of the vehicle and are thus immune from road shocks.
- (7) A substantial load carrying member can be employed, which in the event that it is damaged through accident is not likely to result in damage to the drive shaft and the gears.
- (8) The differential gears and the drive shaft can be made lighter than in most of the other types as the maximum torque is produced only at the rear wheels.
- (9) The universal joints are arranged to run in line between the transmission and the engine, since both are attached rigidly to the chassis.
- (10) Offers the lowest unsprung weight, thus increasing the riding comfort.

Chain Drive on Heavy Trucks

Some firms use the chain drive exclusively for their heavier models but give the purchaser the option of a chain drive or a double reduction drive in the smaller sizes. The former offers a greater road clearance than the live-axle type of drive and a much greater range of gear-ratio changes than any other type. In the Mack truck, for instance, gear ratios can be made from $6\frac{1}{2}$ to 1 to 14 to 1, without altering anything but the sprockets and perhaps adding or taking out a link or two of the chain.

In addition to greater wear and noise, chains will require more frequent repairing and renewing than the gears of the worm or bevel drives. When sprockets are worn until they are hooked, or until the true form has been destroyed and the teeth are slightly hooked at the ends of the driving side, they will cling to the chain as it leaves the sprocket and are then pulled away violently. It is claimed that this fault can be remedied by some forms of sprocket design. The chain drive is superior to the worm drive under heavy load and torque and only slightly less efficient than the worm under high speeds and light loads.

In the internal gear driven axle, first a bevel reduction is provided between the propeller-shaft and the rear axle, as in most passenger cars, and to obtain a further reduction at the end of the live axle near the wheel or in the hub small spur gears mesh with internally cut gears attached to the wheel.

One of the advantages claimed for the internal gear driven axle is great strength, since it permits the use of a solid, one-piece load carrying member, usually a drop forging of I-section or a round axle made from bar stock. Sometimes the load carrying member is flattened and shaped in the center to encompass the differential housing, while in some designs the live axle is within the load carrying member. Other advantages are (a) this axle can be made lighter than the worm gear type, since the

*Condensed from a paper presented at the March meeting of the Metropolitan Section, Society of Automotive Engineers.

jackshaft and the differential run at a lower torque than in the worm drive axle, the great speed reduction being made at the wheel, while the reduction at the bevel gears in the center of the axle is usually less than 2 to 1; (b) the internal spur gears and pinions are mounted on fixed centers and require no adjustment; and (c) the cost is low, while the efficiency is high and fairly constant at all loads.

One of the serious problems with most of the internal gear axles is the proper lubrication of all the parts of the drive, although it is claimed by its sponsors that this drive can run with very little lubrication. The large diameter at the ring gear gives plenty of opportunity for the grease to leak out around the edges of the gears and onto the brake. However, some types run in a constant bath of oil, and the joint is not close to the large diameter of the ring gear, but nearer the center. Another objection against the internal gear is that it is more difficult to provide the double internal brakes on the wheel. Even where the internal brake is used, considerable difficulty is experienced with the rise in temperature due to the application of the brakes, which may cause the lubricant to melt or burn. At present the tendency is to use internal rather than external brakes, as the latter form is exposed to dust and grit. The internal gear, as usually constructed, cannot be made in the semi floating construction, thereby eliminating the use of this design where the bearing pressures can be considerably reduced over those in the full floating type.

Disadvantages of Internal Gear Axle

Opponents of the internal gear axle further claim that it has several fundamental defects. In most of the internal gear types the load carrying member is the dead axle, but in some a central live member is inside the dead member, one or more extra idler gears being inserted between the jackshaft pinions and the internal gear rings in the wheel hub. In all internal gear axles the internal gear is carried by the wheel, or else in the wheel hub between bearings, and all wheels will develop a certain amount of play, since they have to take the road shocks. They will therefore not continue to run perfectly true, and the gears will not maintain their exact relation. If the gears run out of alignment with each other, instead of on a line contact, the contact will take place only on a point, under which condition gears cannot wear well or run silently nor transmit the power efficiently, for the slight play in the wheel will cause them to rock to and fro slightly.

In most internal gear axles the wheels are mounted on some form of dead axle while the jackshaft, running parallel, is either in front of or behind it and encased in a separate housing, whose only function is to retain the live member. If axis of shaft and dead axle do not retain their parallelism, there is an additional tendency to throw the gears out of alignment. The torque reaction tends to revolve the jackshaft about the dead axle and is restrained from doing so only by the security of the end fastenings and by the rigidity of the dead axle against twisting. If the torque were always equal at both ends of the jackshaft, the twisting moments would be balanced, but since the traction of the two wheels is not absolutely equal, varying greatly at times, the torque stress on the axle is not equal on both ends. It is therefore claimed by opponents that this inequality of torque upsets the absolute parallelism of the two members, which will have a tendency to throw the pinions out of alignment with the internal gears.

In some constructions the load is carried on the dead axle, the jackshaft being perfectly free, not centrally supported; hence it is not deflected when the axle is de-

flected, and this will have a tendency to pull the gears out of line and cramp the pinion bearings. Sometimes means are provided to take care of the deflection by providing a universal-joint in the jackshaft, as in the rear axle of the De Dion-Bouton Co., and the Rochet-Schneider Co. of France. This, on the other hand, introduces a more complicated mechanism and a larger number of parts.

The type that has a separate dead axle weighs more for a given strength, since the larger outside dimensions of a hollow tube offer more strength with less weight; hence for the same factor of safety a solid axle is heavier than one of tubular construction. However, against the disadvantages enumerated is the fact that over 22 per cent of the models of trucks built in this country employ the internal gear drive and among its adherents are some of the well known companies.

The Worm Drive Axle

The worm and worm gear are usually assembled in a unit and then attached to the axle housing. In this axle the road shocks or stresses, except those coming through the driving axle, do not tend to disturb the alignment of the worm gear. Provisions should be made for preventing the oil in the center of the housing from running out through the hubs. Oil retainers are sometimes used on both the axle shafts and the wheel hubs for this purpose. A vent pipe in the rear axle housing will assist in overcoming oil leaks. Adherents of this axle claim that its average efficiency is very high and that a truck equipped with a high ratio will coast quite freely.

The great advantages claimed for the worm gear axle are the perfect mechanical enclosure of the final drive which is running in a bath of oil, and its practically noiseless operation. Even the wheel bearings are lubricated from the center housing, and when proper provisions are made there is no danger of the lubricant saturating the brakes. When the housing is filled with a suitable oil, the latter will last up to 5000 miles. Due to the perfect enclosure, dirt and grit are positively prevented from reaching the mechanism. Worm gear axles are frequently equipped with double internal brakes, a construction which affords excellent protection against dirt and grit. It is claimed that wheel brakes are more satisfactory than propeller-shaft brakes, for with the latter the stresses in the drive-shafts and the gears are considerably greater than when wheel brakes are employed, the torque arising from the locking of the wheels of loaded trucks being much higher than that of the engine.

Advantages of Worm Gear

Other advantages claimed for the worm gear are (a) its great simplicity, it having the fewest number of parts; (b) it is possible to obtain any desired reduction with two pieces, the worm and the worm wheel; (c) it is possible to obtain an almost straight drive from the engine to the rear axle; and (d) its durability is very great. It is better to have the weight in the center of the axle than at the axle ends, for when one wheel rises, or hits an obstruction and is thrust upward, the upward acceleration in the center of the axle will be only one-half of that at the wheel; hence the stresses induced will be smaller, and the action will be more like that of a smaller unsprung weight than if the weight were at the wheels.

Opponents of the worm gear claim that (a) it is a highly efficient power transmission gear only under certain conditions, for under a heavy torque a worm gear has a very low efficiency, while at high speed under light load, its efficiency is high; and (b) in coasting there is a certain amount of friction in the worm and the gear. Tests made by the International Motor Co. showed that trucks equipped with a worm drive did not coast as well as other types; hence, it is claimed, that even though the worm

may be more efficient than the chain under certain conditions, its average efficiency throughout the range of conditions encountered in service is lower.

The most vulnerable part of the worm drive is the bearing, which takes the enormous thrust exerted by the worm. In some axles ball bearings are provided at this point; others are equipped with taper roller bearings. Since the worm must be carried on the top to obtain sufficient road clearance, the worm bearings can be lubricated only by the oil carried up or thrown up as the worm wheel rotates. When this runs at a low speed, sufficient oil is not always carried to the top. To provide sufficient lubrication special means, like oil troughs, are sometimes fitted inside the worm wheel housing to catch the oil and lead it to the bearings. The worm drive is more expensive than other forms, but it is claimed that the maintenance cost is considerably less. When the pressure on the worm is not too high, the gears properly cut and the lubrication adequate, the film of oil is not squeezed out from between the surfaces, and there is very little friction. However, when the pressure is excessive and the oil is squeezed out, considerable friction exists and damage may result in a short time.

Another reason for rear thrust bearing failures is that the necessary play in the worm takes the form of a blow on the thrust bearing whenever the clutch is thrown in or speed changes are made. While taper roller bearings or ball bearings can withstand high pressure, they cannot withstand impact very well. Trouble with thrust bearings may also be caused by improper clearances, which, under excessive strain or deflection, cause an increase in the temperature with a consequent elongation of the worm. In the worm drive the torque induces pressure on comparatively small surfaces of the teeth, which rub one on the other, while with toothed gears or chains and sprockets there is more of a rolling contact than pure friction.

Some manufacturers claim that torque arms and radius rods impose additional stresses on the worm; hence they advocate the Hotchkiss drive. With this a cushioning effect is imparted to the drive as the springs permit the axle to rock back slightly in starting, thereby reducing the pressure on the worm teeth when the car is first started and the torque is high. It is also claimed that it permits the worm and the wheel to oscillate, thereby working more oil between the surfaces than is possible with a rigid drive. On the other hand, opponents of the Hotchkiss drive in connection with worm gears claim that they must put extra weight into springs when the latter are used to perform the functions of the torque and radius rods, and wherever satisfactory results are obtained with the Hotchkiss drive the springs must have a greater factor of safety. I believe that the Hotchkiss drive when properly designed gives satisfaction, even though the springs are relied upon to perform more severe functions. While many objections are brought forward against the worm drive, 68 per cent of all the truck models manufactured in the United States use this type of final drive.

The Double-Reduction Drive

In the double reduction rear axle two reductions take place between the propeller-shaft and the live axle. The first reduction is by a pair of bevel gears and the second by a pair of spur gears, or vice versa. Instead of straight bevel or spur gear teeth, helical teeth can be employed.

The advantages claimed for this type are (a) simplicity of construction, in that only comparatively small bevel and spur gears are employed, which lend themselves easily to quantity production; (b) all the gears are perfectly enclosed and protected from dust and grit, and run in a bath of oil; (c) its average efficiency is as high as that of any other drive and is substantially constant under all speeds and loads; and (d) the gears will always remain

in alignment and are silent in running when well fitted.

The disadvantages cited against this drive are (a) an increased number of parts over the worm gear drive; (b) it is heavier than the internal gear and the chain drive, since the live axle has to carry the entire torque; and (c) it is more costly to manufacture.

Semi Floating Axles

By calculating the bearing loads and the shaft stresses of semi-floating and full-floating axles we will be in a position to determine their merits and demerits.

To find the bearing loads and the shaft stresses in semi-floating rear axles three distinct conditions must be considered. These are

- (1) The maximum torque plus the normal radial load on the wheel.
- (2) The wheel locked and skidding forward when the brakes are applied.
- (3) The wheel skidding sidewise while the truck is running.

For example, a certain high grade truck axle has a

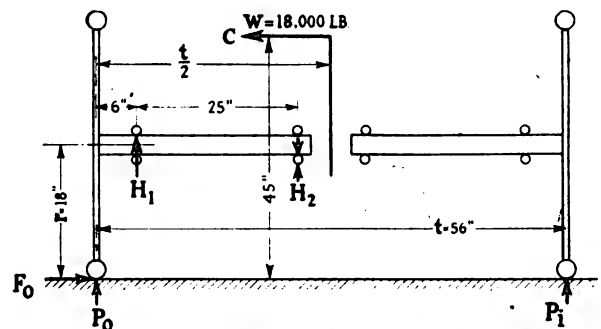


Fig. 1—Diagram illustrating the bearing loads and shaft stresses in a semi-floating axle

maximum total reduction of 49.61; the maximum horsepower is 50 at 1000 r.p.m. and the load on each rear wheel is 9000 lb. The torque in the rear axle shaft with a transmission efficiency of 85 per cent, and running in low gear is 132,850 lb-in. or one-half this amount, 66,425 lb-in., in each half of the rear axle shaft. On the other hand, if a transmission brake is employed or if the engine is speeded up and the clutch thrown in suddenly, causing the rear wheels to slip on the ground, the maximum force at the periphery of the wheel is $0.6 \times 9000 = 5400$ lb., 0.6 being the coefficient of friction between the tire and the road surface, and if the wheel diameter is 36 in., the torque in each half of the shaft is $18 \times 5400 = 97,200$ lb-in. However, we will not consider these conditions, for in our example no propeller-shaft brake is employed, and steel can stand a large momentary occasional overload without serious damage.

The shearing or torsional stresses in the shaft can be found from the well-known formula

$$S_s = T/J$$

where

J = the polar section modulus

S_s = the shearing stress in pounds per square inch

T = the torque

The diameter at the weakest point of the axle, which is close to the inner bearing, is 2.4375 in. The polar moment of inertia at this point is 0.1963 times the cube of the diameter. Substituting these values in the formula for the shearing stress, we have

$$S_s = 66,425 \div [0.1963 \times (2.4375)^3] \\ = 23,390 \text{ lb. per sq. in.}$$

At the outer bearing the shaft is 4 in. in diameter and the stress due to torsion at this point calculated from the formula is approximately 5280 lb. per sq. in.

We will now consider the bearing loads and shaft

stresses due to the bending moments. Under ordinary running conditions the radial load on each wheel is 9000 lb.; the distance between the bearing centers is 25 in., and between the outer bearing and the center of the wheel 6 in. approximately as shown in Fig. 1. If H_1 is the reaction or the radial load on the outer bearing, and H_2 that of the inner or the differential bearing, and if the radial load on the wheel is designated by P , then, taking moments about the outer bearing, we have

$$6P = 25H_1, \text{ hence } H_1 = (6 \times 9000) \div 25 = 2160 \text{ lb.}$$

Taking moments about the inner bearing,

$$31P = 25H_2, \text{ and } H_2 = (31 \times 9000) \div 25 = 11,160 \text{ lb.}$$

The bending moment in the shaft, 1 in. from the inner bearing, is 2160 in.-lb., increasing toward the outer bearing, where it is $2160 \times 25 = 54,000$ in.-lb.

The tensile and compressive stress S of a shaft is found from the formula

$$S = B/Z$$

where

B = the bending moment

S = the tensile and compressive stress of a shaft

Z = the section modulus

The section modulus, not the polar section modulus, of a round shaft is 0.098 times the cube of the diameter. Near the outer bearing of the shaft the diameter is 4 in. Substituting in the formula, we have

$$S = 54,000 \div [0.098 \times (4)^3] \\ = 8600 \text{ lb. per sq. in.}$$

Near the inner bearing the diameter is 2.4375 in. and by substitution in the formula we find the stress equals 1523 lb. per sq. in.

Torsional and Bending Stresses

To find the stress in a shaft subjected to torsion and bending stresses, we may make use of an equivalent twisting moment T_c , which would create the same stress in the shaft as that due to the combined twisting moment T and the bending moment B and is equal to the square root of the sum of their squares. Near the inner bearing

$$T_c = \sqrt{(2160)^2 + (66,425)^2} = 66,500 \text{ in.-lb. appr.}$$

almost the same as that found for the twisting moment only. At the outer bearing

$$T_c = \sqrt{(54,000)^2 + (66,425)^2} = 85,000 \text{ in.-lb. appr.}$$

The stress in the shaft at the outer bearing is therefore

$$S_s = T_c \div J = 85,000 \div 12.56 \\ = 6570 \text{ lb. per sq. in. approximately}$$

While at the inner bearing

$S_s = 66,500 \div 2.84 = 23,400$ lb. per sq. in. approximately, showing that the stress in the shaft is much greater near the inner bearing.

The material used for this shaft is S.A.E. Steel No. 2340, which, if heat-treated to a Brinell hardness of 335, or a scleroscope hardness of 51, has a tensile-strength of 175,000 lb. per sq. in. and an elastic-limit of 150,000 lb. per sq. in. The shearing strength of steel is approximately 85 per cent of its tensile-strength or

$$175,000 \times 0.85 = 149,000 \text{ lb. per sq. in.,}$$

while the transverse elastic-limit or the elastic limit in shear is approximately 35 per cent of its ultimate shearing-strength, and this should be considered when finding the factor of safety. Therefore, the elastic-limit in shear equals

$$149,000 \times 0.35 = 52,150 \text{ lb. per sq. in. approximately.}$$

Very few data seem to be available as to the elastic-limit in shear of various steels, but at the weakest portion of the shaft the factor of safety is

$$52,150 \div 23,400 = 2.23 \text{ approximately}$$

under normal conditions, when running in low gear.

Next we will investigate the bearing loads and shaft stresses when the brakes are applied and the wheel is locked and sliding forward. In this case there is a hori-

zontal force at the periphery of the wheel equal to the vertical or normal load of 9000 lb. resting on it multiplied by the coefficient of friction 0.6, as was mentioned before, or 5400 lb. The two forces, the vertical and the horizontal, act at right angles to each other. The resultant radial load R on the wheel due to these two forces is equal to the square root of the sum of their squares or 10,500 lb. If we call the reactions or bearing pressures in the outer and inner bearings H_1 and H_2 respectively, by taking moments about the outer bearing we have

$$6R = 25H_1,$$

from which

$$H_1 = 6R \div 25 = (6 \times 10,500) \div 25 = 2520 \text{ lb.}$$

Taking moments about the inner bearing, we have

$$31R = 25H_2;$$

hence

$$H_2 = (31 \times 10,500) \div 25 = 13,000 \text{ lb.}$$

The bending moment near the inner bearing is 2520 in.-lb., and near the outer bearing it is

$$25 \times 2520 \text{ or } 6 \times 10,500 = 63,000 \text{ in.-lb.}$$

Then, since $S = B/Z$, at the inner bearing

$$S = 2520 \div 1.418 = 1770 \text{ lb. per sq. in.}$$

and at the outer bearing

$$S = 63,000 \div 6.28 = 10,000 \text{ lb. per sq. in.}$$

approximately, the values for Z at the inner end of the shaft being 1.418 and at the outer end 6.28 as found before. It is seen, therefore, that under these conditions, with the wheels locked and sliding forward, the stresses in the shaft are very low, especially in view of the fact that the shaft is subjected to bending stresses only. The material is in tension and compression, and its elastic-limit is 150,000 lb. per sq. in.

Stresses Due to Side Skids

We will now consider the bearing loads and shaft stresses resulting from skidding sidewise when turning a corner at a certain speed. Under these circumstances the centrifugal force F_c , which causes the rear of the truck to skid, will equal the coefficient of friction, 0.6, multiplied by the total weight, $6W$, carried by the two rear wheels. In this case, therefore, $F = 0.6 \times 18,000 = 10,800$ lb.

Assuming that the center of gravity of the entire load on the rear wheels is located 45 in. from the ground and calling this distance h ; that the total pressure between the two rear tires and the ground is designated by P ; that P_o is the pressure on the outer wheel and P_i that on the inner wheel when rounding a curve; that the tread, t , is 56 in. and that the radius of the wheel, r , is 18 in., then, by taking moments about the point where the inner wheel touches the ground, we have

$$P_o \times t = (W \times 1/2t) + (F_c \times h)$$

or

$$P_o = 1/2W + [(F_c \times h) \div t]$$

Substituting the assumed numerical values, we obtain

$$P_o = (18,000 \div 2) + [(10,800 \times 45) \div 56] \\ = 17,700 \text{ lb.}$$

The load on the inner wheel will be 9000 — 8700 or 300 lb.

In addition to the radial load, there is a thrust load L , on the two wheels arising from the tendency to skid; this thrust load is equal to the centrifugal force F_c and is divided between the two rear wheels in proportion to their radial load. Hence, the thrust load on the outer rear wheel between the tire and the ground

$$L_o = 0.6 \times P_o = 0.6 \times 17,700 = 10,600 \text{ lb.}$$

Thus the total radial load on the outer wheel is 17,700 lb., and the side-thrust at the bottom of the wheel 10,600 lb. Taking moments about the inner bearing, we have

$$31P_o = 25H_1 + (r \times L_o)$$

or

$$H_1 = [31P_o - (r \times L_o)] \div 25$$

Substituting the corresponding numerical values for the various letters, we have

$$H_1 = [(31 \times 17,700) - (18 \times 10,600)] \div 25 \\ = 14,300 \text{ lb.}$$

Taking moments about the outer bearing we have

$$6 P_o = 25 H_1 + (r \times L_o) \\ H_2 = [6 P_o - (r \times L_o)] \div 25 \\ = [(6 \times 17,700) - (18 \times 10,600)] \div 25 \\ = -3384 \text{ lb.}$$

The result is a minus quantity, as the bearing will carry the load on the top, while under normal running it will carry it at the bottom. It should be remembered that the outer bearing also has to carry a thrust load of 10,600 lb.

Knowing the bearing pressures or the reactions we can easily find the bending moments and the stresses in the shaft, as in the last example. The bending moment B near the inner bearing is 3384 in.-lb. and near the outer bearing

$$25 \times 3384 = 84,600 \text{ in.-lb. approximately.}$$

In addition to the bending moment due to skidding, the twisting moment in the shaft due to the drive must be considered. Evidently the truck will have to be in the high gear to travel at the requisite speed to produce skidding; hence the torque will be much lower, but even if the truck were in the low gear, and the torque be 66,425 lb.-in., the maximum stress in the shaft would be barely higher than under *straight forward* travel, when in the low gear. If the low gear torque is added, the equivalent twisting moment near the inner bearing is practically the same as that found before, 66,500 in.-lb., and the shearing stress equals 23,400 lb. per sq. in. Near the outer bearing the twisting moment has a value of approximately 107,000 in.-lb., and the stress is 8550 lb. per sq. in. When skidding sidewise the torque is considerably lower in practice, for the truck would not skid unless it traveled in one of the higher-speed gears, unless the road surface were muddy or slippery, and in such event the coefficient of friction is considerably lower; hence the bending moment would be lower. The maximum stress in shear is therefore near the inner bearing on straight forward travel in the low gear and amounts to 23,400 lb. per sq. in.

Full-Floating Axles

The stresses in the shaft of a full-floating axle are purely torsional or shearing stresses, and if the engine power and gear reduction are as in the last example, the maximum torque will be as found before, 66,425 lb.-in. in each axle shaft. If the shaft dimensions are the same as in the previous example, the maximum unit-stress for torsion in the shaft metal would be as that found before, 23,390 lb. per sq. in. In a full-floating axle the shaft dimensions are, as a rule, uniform, not tapered as in the semi-floating type, since the live axle is relieved of all bending moments by the wheel bearings.

The maximum radial load on the wheels, when the brake is applied and the wheels slide forward, is the resultant radial load due to the combined horizontal and vertical forces and is the same as found before, 10,500 lb. If the distance between the bearings is 7 in., as shown in Fig. 2, the inner bearing H_1 is $2\frac{1}{2}$ in. from the wheel center, and the outer bearing H_2 $4\frac{1}{2}$ in., then, by taking moments about the outer bearing, we find

$$7 H_1 = 4.5 \times 10,500, \text{ hence } H_1 = (4.5 \times 10,500) \div 7 = 6750 \text{ lbs.}$$

and the load on the outer bearing

$$H_2 = (2.5 \times 10,500) \div 7 = 3750 \text{ lb.}$$

When the wheels skid sidewise, the bearing loads on the outer wheel are considerably higher. If the centrifugal force F_o that produces the skidding, and the radial load P_o are, as found before, 17,700 and 10,600 lb. re-

spectively, then by the law of moments we obtain

$$7 H_2 = 4.5 P_o + 18 F_o$$

hence

$$H_2 = [(4.5 \times 17,700) + (18 \times 10,600)] \div 7 \\ = 38,700 \text{ lb.}$$

and

$$7 H_1 + 18 F_o = 2.5 P_o$$

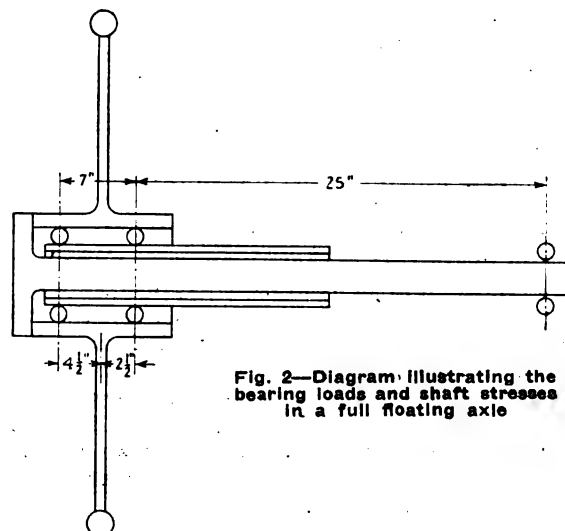
from which

$$H_1 = [(2.5 \times 17,700) - (18 \times 10,600)] \div 7 \\ = -21,000 \text{ lb. approximately}$$

showing that on the outer bearing the load is reversed from its normal direction. In addition there is a thrust load of 10,600 lb. The results obtained are given in Table 1.

TABLE 1—COMPARISON OF STRESSES AND BEARING LOADS IN SEMI-FLOATING AND FULL-FLOATING AXLES

Type of Axle	Semi-Floating	Full-Floating
Maximum Stress, lb. per sq. in.		
Near wheel	8,550	23,390
Near differential	23,400	23,390
Maximum Bearing Load, lb.		
Outside of wheel .....	.....	-21,000
Inside of wheel	14,300	38,800
At the differential	-3,384	.....
Thrust load	10,600	10,600



From Table I we can judge that the maximum shaft stresses are practically the same in both designs, but the shaft in the full-floating axle can be made lighter and at less cost since the stress is uniform in the entire shaft and the shaft is relieved of all but torsional stresses. Furthermore, in the semi-floating axle, the bending stresses are continually reversed; therefore a higher factor of safety should be used. The bearing loads in the full-floating axle are considerably higher, which will impose a much greater bending moment on the axle housing. Hence the bearings and the axle housing must be made heavier and thus this axle will be more expensive to manufacture than the semi-floating axle.

Standardization of Axle Parts

Following the presentation of the foregoing paper the chairman stated that the Council of the Society had asked the sections to take a more direct interest in the standards work of the Society, and that for this reason he had requested C. T. Myers of the Truck Division of the Standards Committee to discuss standardization possibilities in reference to rear axles for trucks. Myers thereupon made the following remarks giving his views on this subject:

Myers Suggests Axle Standardization

A casual glance through Favary's paper by an S. A. E. Standards Committeeman will cause him to contemplate with awe the enormous investment in axle spare parts it must entail to service the different makes of motor trucks already in operation. Further contemplation multiplies this by the amount of different manufacturing tool equipment necessary to produce them, and the terrific expense it must entail to keep the many little armies of salesmen each fighting their twenty sided battles over unimportant detail. Eighty million dollars is spent every year to sell trucks—a large part of it going to support fruitless detail arguments. The truck industry now generally recognizes that it must sell transportation and not details, and there seems to be a large opportunity to standardize on axle details. Everyone at interest will benefit by this, for all the well known types of rear axles are firmly established in the trade and give very good results in use. The user is not interested in axles if they carry his goods without disturbing his peace of mind. When accidents happen or wear takes place, however, he wants repairs made quickly and cheaply. This not only saves him money but keeps him in the frame of mind to spend it in buying another truck.

Having in mind that any suggestions I may make will be promptly corrected or amplified, I will put before you certain features of the various axle designs which seem to offer more or less attractive fields in which to pursue the well-defined and enormously profitable policy of standardization, which has been steadfastly fostered by the Society of Automotive Engineers.

The various types perform exactly similar functions in a variety of ways. (a) They support the springs on which rest the weight of body and pay load. (b) They carry brakes. (c) They are supported by the wheel bearings. (d) They carry parts which transmit the engine torque. For equal loads, stresses and similar points of attachment it is natural to think that the same bearings, proportion and size of parts, etc., will serve as well on one axle as another. In this light we can investigate the present subject by comparing the similar aspects of the various axles.

The range of truck sizes to-day may be divided roughly into 7 categories as indicated by their pay load capacities, viz., $\frac{3}{4}$ -ton, 1-ton, $1\frac{1}{2}$ -ton, $2\frac{1}{2}$ -ton, $3\frac{1}{2}$ -ton, 5-ton and $6\frac{1}{2}$ -ton.

1—For each category standard spring center-lines and spring widths can be established, giving a reasonable variation for the time being by using spring pads that are wider than necessary. The spring centers will depend upon frame widths, a subject which is now being attacked with every reason to expect success. These established, the spring clips and nuts will readily fall in line. Even the spring pad drilling and spring seat height offer possibilities of being reconciled between chain drive and internal gear axles, and also among single reduction, double reduction and worm drive axles.

2—Standard brake drum diameters, widths and metal thicknesses are now being discussed in the S. A. E. Standards Committee and tentative dimensions have been suggested. Once these are determined the door is open to the crying need for standardizing the dimensions of brake linings, rivets, hinge pins, cams or toggles, diameters of camshafts and bushings, fits for camshaft levers, clearances and movements, release springs and all the unessential details that are so annoying when replacements are needed at an inopportune time or in an out-of-the-way place. There will be double paths to follow here by those who differ as to having more than one

brake inside the drum, and possibly by the adherents of an external brake.

3—Once the brake drum width is selected the wheel spoke is located. The wood wheel can readily fall in line here and the steel wheel also. Our tire sizes are standard and also their fits on the wheels. Standard practice with reference to front wheel hubs has already been adopted by the S. A. E. The rear hubs should also yield to the same analysis and attack, although the solution will not be so simple. The hub details depend upon the type, size and location of the bearings used.

4—The wheel bearings cause a considerable diversification. Either ball or roller bearings can be employed in each of the five types of axles most used. But of these five types single reduction, double reduction and worm-drive can be grouped in both the fixed hub or full floating designs; while chain drive and internal gear drive can also be grouped. Thus, for each size truck axle 16 variations in bearing sizes, types, fits and spacing can be reduced to 6. Possibly a thorough study of the situation would still further reduce these as was found possible in the front hub bearing standardization, where over 200 hub variations were boiled down to 10, which are served by only 14 bearings.

5—Hubs, flanges, hub caps and wheel fits can be correspondingly standardized once the bearings are fixed.

6—The fits at the outer ends of spindles and drive shafts can be standardized in accordance with the classification given under 4; and if the wheel tracks are held close the spindles and drive shafts themselves offer possibilities.

7—4, 5 and 6 will react on the spring pads mentioned under 1, and help reconcile some discrepancies which may at first occur there.

8—Differentials can be standardized and the subject is now under consideration. A reasonable number of sizes, which will cover the range of torques to be transmitted, is all that is necessary. It should make little difference in what type of axle they are used. There would be a series for ball bearings and a series for roller bearings.

9—The above accomplished the fits for the inner ends of drive shafts would fall in line.

10—Bevel gearing, spur gearing and worm gearing all offer great opportunities for standardization. This should lead to a similar accomplishment for the bearings and bearing fits on worm spindles and bevel pinion spindles, but these can be standardized whether or not the gearing is standardized.

11—Adjusting devices for differential bearings and spindle bearings also offer a field.

12—The spindle fits for universal joint flanges have already been standardized.

13—Clevises and pins for brake lever connections have already been standardized. Possibly the levers themselves are susceptible to similar standardization.

Discussion of Favary Paper

O. M. Burkhardt, of the Pierce-Arrow Motor Car Co. submitted a written discussion in which he explained his reasons for favoring the full floating type of axle for carrying loads up to 12,000 lb. He gave figures to show that the full floating construction is impracticable for greater weights than this.

W. F. Rockwell of the Wisconsin Parts Co. stated that he much favored the semi-floating design which he said weighs less in some instances than the full floating type. He stated that the cam-operated internal brake appears to be the only type which is not rendered inoperative at

times by snow and slush. He stated that he does not favor the propeller shaft brake because of its great sensitiveness, short life due to higher speed and the possibility of serious accident in case of shaft breakage which sometimes occurs before the truck operator realizes that the brake has become inoperative as a means for retarding the speed of the vehicle. He said that the use of bevel gear and double reduction truck axles is increasing and that in England, where the internal gear type was once used, it has been superseded by either double reduction or worm types. The double reduction type of construction involves lower stresses, he said, and less likelihood of costly renewals, due to injury. In common with most engineers, he favors light unsprung weight, but not so light as to interfere with proper alignment of the parts. All axle designs, he said, are compromise designs in which disadvantages are minimized as far as possible.

Effect of Unsprung Weight

A great deal of the discussion centered around the matter of unsprung weight. Favary stated that the greater the weight the greater will be the kinetic energy imparted to an axle where it is raised a given amount in passing over a bump in the road; consequently, the greater will be the shock imparted to the chassis with a given spring suspension. In this connection C. T. Myers stated that there is great uncertainty in regard to the effect of unsprung weight on tire wear. It is generally assumed that tire wear increases with increase in unsprung weight, but Myers stated that he had yet to see any conclusive experimental evidence to substantiate this assumption. He mentioned certain tests in which it had been found that tire mileage on some worm-drive Pierce-Arrow trucks was as much as 70 per cent greater than that on similar trucks using chain drive, therefore presumably having much less unsprung weight on the rear axle.

R. E. Fielder of the Fifth Avenue Coach Co. stated that from 1910 to 1913 the tire cost on De Dion buses used by his company was 2½ cents per mile. These buses had extremely heavy rear axles in which the wheels alone weighed over 700 lb. The present cost per mile for tires on buses equipped with a worm-driven axle some 700 lb. lighter than formerly employed is about 0.85 cents. This result is not attributed so much to difference in unsprung weight as to improvements in the tires themselves, and the fact that steel wheels, which are said to hold their shape better than wooden wheels formerly employed, are used. Fielder considers that light, unsprung weight is an advantage, however, not only in respect to tire wear, but in respect to damage to the road surface, which is less with the lower unsprung weight. This fact should not be overlooked as it is certain to ultimately have, directly or indirectly, a considerable bearing upon the cost of bus operation.

Advantages of Semi-Floating Axles

In one type of construction employed by the Fifth Avenue Coach Co. Fielder stated that it had been possible to effect a saving of 66 lb. in weight by the use of tubular as against solid axle shafts. He agreed with the author of the paper to the effect that it is better to have unsprung weight at the center than at the ends of the axle. He stated that the semi-floating type of axle possesses considerable advantage from a service standpoint in that it is not necessary to disturb the wheel bearings when the wheels are removed to change tires or repair brakes. With the full floating type of axle dirt is apt to get into the bearings when the wheel is removed and the bearings are not always properly adjusted when the

wheel is replaced with the result that rapid wear of the bearings occurs.

Replying to Fielder's criticism of the wood wheel, Myers stated that careful comparative tests of wood and steel wheels had shown an advantage of 12 per cent in tire mileage in favor of the wood construction.

M. C. Horine of Mack Trucks, Inc., drew attention to the disadvantages of using two sets of brakes bearing on the same drum, since overheating caused by the use of one set of shoes adversely affects the efficacy of the second set. For this reason he favors the use of a propeller shaft brake which, he stated, is the only fully equalized type and is therefore least apt to cause skidding. Shaft brakes are serviceable, he said, if rigidly mounted on frame cross members. They are not in any case affected by spring action as are some wheel brakes.

Horine also drew attention to the advantages of a drop forged double reduction axle with banjo set at 45 deg., such as is used in some models of Mack trucks. He stated also that the chain drive has been much improved in recent years as have other types of drive. In answer to a question regarding chain life he stated that the chains used on Mack trucks give an average service of 18,000 to 21,000 miles.

C. W. Spicer of the Spicer Mfg. Co. stated that in his long experience in the manufacture of universal joints and propeller shafts, he had been unable to find that these parts are subject to any higher stresses when the propeller shaft brake is employed than when the brakes are on the rear wheels, but Favary took the view that the use of a transmission brake entails higher torque on the propeller shaft and universal joints and results also in greater axle stresses.

Propeller Shaft Breakage

A. F. Masury, chief engineer of Mack Trucks, Inc., stated that propeller shaft brakes are satisfactory only when they are well supported, and otherwise properly designed. He stated further that his experience had shown that propeller shaft breakage is most apt to occur when the driver allows the engine to stop when the truck is coasting and then suddenly re-engages the clutch as a means of cranking the engine. He said also that the use of a full-floating axle with a live axle shaft made of very high grade steel provides a very flexible drive. Axle shafts used in late Mack trucks can, he said, be twisted through three full revolutions before breaking.

Masury stated that careful tests made by his engineering organization on trucks equipped respectively with chain drive, double reduction and worm gear axles had shown superior performance of the first two types, in coasting, climbing grades on second speed, average speed on hills, maximum torque and drawbar pull.

Masury cautioned against the possibility of the ill effects of too comprehensive standardization which, he said, would tend to prevent initiative and progress in improving design. He cited the Master Car Builders' standards as having prevented engineering development in the railway field, and said that the most successful concerns in the passenger car industry had paid least attention to standardization. C. T. Myers took exception to this view, stating that the most completely standardized passenger cars have proved to be the greatest commercial success. He also stated that M. C. B. standards had greatly simplified the problem of repair work wherever this work had to be done.

H. C. McBrain stated that it is possible to make spiral bevel axles with reductions of 9 or 10 to 1 and that with the multiple direct drive type of axle which he advocates it is possible to secure much higher fuel mileage than is usual with single bevel gear construction.

The Relation of Carburetion to Fuel Economy

Part II

Vaporization from a theoretical and practical standpoint is discussed by the author who concludes that proper operation of the entire carbureting system depends on complete and instantaneous combustion of the fuel.

By J. N. Golten

Figs. 10 to 14, taken from P. S. Tice's paper, "Flow in Intake Manifolds and Cylinders," give a visual indication of the complex flow lines in a simple two-branch manifold, and their variation with change in throttle opening.

Figs. 10 and 11 show the conditions existing in the manifold with the throttle slightly open. Notice that the fuel is not evenly distributed throughout the manifold cross-section, but flows in a comparatively concentrated stream. (Due to the small cross-section of the fuel stream the vaporization rate is greatly reduced. See section on Rate of Vaporization.) Of perhaps even greater interest is the fact that the flow lines in the two horizontal sections of the manifold are entirely different. This would affect the vaporizing action of a centrally located hotspot. A significant fact shown by Figs. 11 and 12 is the collection of fuel in the idle branch of the manifold when the right-hand cylinders are aspirating, and the absence of this collection when the left-hand cylinders are being charged. This phenomenon accounts for some of the inequalities of distribution.

* March, 1921, Issue of the *Journal of the Society of Automotive Engineers*.

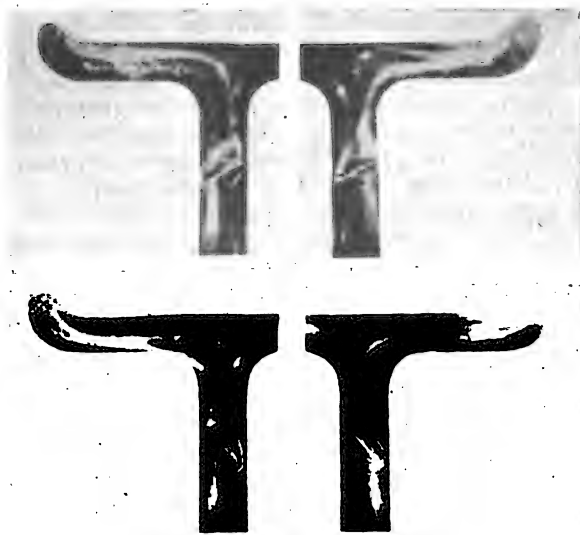


Fig. 10—(Above)—Note the concentrated fuel stream and unsymmetrical distribution in the manifold branches with the throttle slightly open. Fig. 11—(Below)—Opening the throttle still further does not change the nature of the distribution but results in an accumulation of liquid in one idle branch of the manifold

A further cause of unequal distribution among cylinders is the whirling set up in the bends forming the manifold outlets. Examination of the illustrations will show that in the two ends of the pipe the concentrations of liquid occupy somewhat different positions. When the whirling charge reaches the usual siamesed valve pockets it is almost certain that one cylinder of the pair will receive more of the concentrated stream than the other, a fact that is amply demonstrated by experience. In Fig. 13 is shown the open throttle condition which results in the nearest approach to equal distribution.

Charge Deflection by Throttle Valve

Fig. 14 is a section through the riser of the manifold in a plane at right angles to the outlets of the tee. The illustrations show the variation in the throttle deflecting action as the throttle is turned through 180 deg. Note the intense whirling action as the fuel is drawn into the horizontal section of the manifold. At open throttle the flow in the horizontal branch is unstable, whirling first in one direction and then in the other, which results in a symmetrical figure being recorded by the camera.

The illustrations just referred to are indicative of what happens in all manifolds no matter what their shape or size. Of course, it is true that conditions in some manifolds are much worse than in others; each manifold is a case by itself, but changing manifold shape, while it may improve matters, will never secure perfect distribution throughout the throttling range. Redesigning manifolds to secure better distribution is a long and ticklish task, nevertheless, it would well pay many manufacturers to undertake work of this sort.

Vaporization

Assuming that the metering and distributing problems of a carbureting system have been satisfactorily solved, there still remains the third important carburetion essential, vaporization. Unless all of the correctly metered and distributed fuel in the cylinder is available for combustion, the carbureting problem is still unsolved. Liquid fuel cannot burn; it is only when it is in a gaseous or vaporous state that the hydrocarbon fuel molecule can chemically combine with oxygen and liberate heat. Therefore, in order to secure maximum fuel utilization it is highly important that all the fuel be in such a physical state that its potential heat energy can be utilized.

Not only must the fuel be completely vaporized, but the vaporization must be complete at the time the spark passes in the cylinder. Only that portion of the fuel that is vaporized is effective in forming a combustible mix-

ture. Therefore, if a portion of the correctly metered fuel should remain liquid, the mixture would be so lean as to cause a performance loss. In order to supply this deficiency in vapor content, the operator would be forced to supply an excess of fuel, which entirely upsets the metering relations, causing an attendant loss of economy and other detrimental effects.

That portion of the cylinder heat which is available for vaporization is extremely limited; therefore most if not all of the vaporization must be done elsewhere. Before discussing the means of vaporizing fuels it may be well to state some of the fundamental conditions controlling vaporization.

From the molecular standpoint, vaporization means the flying off of molecules against the forces of molecular attraction, these molecules losing kinetic energy (heat) and gaining potential energy as they leave the liquid. The more rapidly moving molecules will be the first to fly off, hence the average kinetic energy of the molecules remaining behind will be less than the initial average for the liquid, and the liquid will be cooled by evaporation. If the vapor is confined over the liquid, some vapor molecules will strike the surface and become liquid again, and as the number of vapor molecules per unit volume (i.e., the density of the vapor) increases, the number of molecules returning to the liquid per second will likewise increase, until finally the average number returning will equal the average number leaving. Under these conditions the vapor is in equilibrium with the liquid and evaporation ceases. The density, and hence the pressure, of the vapor which will be in equilibrium will depend on the temperature, that is, on the average molecular velocity: A vapor in equilibrium with the liquid is said to be saturated, and the equilibrium pressure is called the saturated vapor pressure (or vapor tension), which for a given substance depends upon the temperature. If the vapor is not allowed to accumulate over the liquid it will remain unsaturated, equilibrium will not be reached and the liquid will gradually disappear by evaporation. The larger the extent of the liquid surface the greater the rate of evaporation. If no external heat is applied to the liquid during the time this vaporization persists, its temperature will progressively decrease and the process of vaporization will become slower and slower. Similarly, if heat is supplied to the liquid at a rate faster than it is being made "latent" by the change in physical state, the process will be accelerated. The vaporization of a definite quantity of a given liquid requires a definite amount of heat, and the faster the heat is supplied the faster is the rate of vaporization.

Rate of Vaporization

Vaporization may be accelerated in three ways:

- 1—By an increase in the exposed liquid surface.
- 2—By the removal of the vapor as fast as it is formed.
- 3—By the addition of heat.

Of these means the last is by far the most effective.

As stated before, the ideal carbureting system would be one in which the fuel would be delivered to the cylinder in such a condition that its vaporization would be complete at the instant combustion commences. To attain this condition the fuel must be completely or largely vaporized before it enters the cylinder, and the remaining liquid portion, if any, must be in the best possible



Fig. 12—Throttle approximately half open. The accumulation of liquid in the idle right hand branch is very evident. Fig. 13—Throttle wide open. The fuel flow in the two branches is practically uniform

condition for rapidly absorbing the limited heat supplied by the cylinder, that is, in a fine state of subdivision so as to present the greatest heat absorbing surface.

In the carbureting system the means of accelerating vaporization are two, namely, extension of liquid surface and addition of heat. It is the problems attendant upon the proper application of these two means that has engaged the attention of the carbureter people the past few years.

Need for Heat

With our modern liquid fuels it requires a comparatively large amount of heat to get complete or nearly complete vaporization of the fuel in the short space of time during which it is traveling from the carbureter to the cylinders. Mere extension of the liquid surface by spraying from the carbureter nozzle will accomplish very little as far as vaporization is concerned, this being especially true with the conventional carbureter in which the throttle plate is placed in the carbureter outlet. No matter how fine the fuel spray may be when it leaves the carbureter nozzle, it is almost immediately recombined after it travels the very short distance between the nozzle and throttle plate, due to striking the latter. Whatever effective spraying is accomplished takes place from the edge of the throttle plate (see Fig. 14). This does not apply at open throttle, but when we take into consideration the fact that more than 90 per cent of the time a car is operating the throttle is more than three-quarters closed, it can be realized that those carbureter manufacturers who claim superior operating properties due to more effective spraying are suffering from a delusion.

Application of Heat

Realizing the need of heat to complete the necessary vaporization it now remains to be seen how this heat may be most economically supplied for the most effective application. Inasmuch as the exhaust gases with their large waste heat content can at all conditions of speed and load supply more than enough heat to completely vaporize all the fuel that is used, they obviously represent a very practical and economical source of the necessary heat. The great problem in connection with vaporization is the practical application of this heat.

About the first method that would suggest itself would be preheating the air before it reached the carbureter by passing it over a section of the hot exhaust pipe. This method would result in a loss of power due to the decreased density of the air. If the air were pre-heated sufficiently to vaporize all the fuel this loss in maximum power would become quite large. The magnitude that this loss may assume may be better realized when it is stated that even with intake air temperatures as high as 500 deg. Fahr. some of the fuel in a manifold still remains in the liquid state.* At this temperature the air

* See "Intake-Manifold Temperatures and Fuel Economy," by W. S. James, H. C. Dickinson and S. W. Sparrow, in the August, 1920, issue of the *S. A. E. Journal*.

density would be approximately one-half of that of air at 80 deg. Fahr. Assuming a constant volumetric efficiency, this temperature would result in a decrease of maximum power amounting to 50 per cent.

Some engineers, in an endeavor to vaporize the fuel without heating the air excessively, have exhaust jacketed portions of the intake manifold. This method has the advantage of transmitting some of the necessary heat by direct conduction to the fuel moving along the walls. However, even with this advantage the method results in high charge temperatures without completely vaporizing the fuel.

Hotspot Manifolds

A further modification in design was the introduction of the so-called hotspots. These are nothing more than

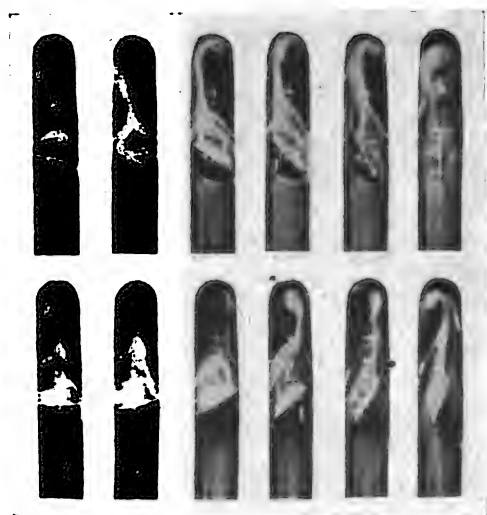


Fig. 14—Change in flow conditions in the manifold as the throttle is rotated through 180 deg. Note the swirling action as the fuel is drawn into the horizontal branch

allegedly highly heated sections in the intake manifold. They are of comparatively small area and are generally placed just above the intake riser on the horizontal portion of the manifold, on the assumption that due to centrifugal force, caused by the rapid change in direction, the fuel would be thrown out onto the hotspot and evaporated. Figs. 10 to 13 show what actually takes place at this point. This method of vaporization does not heat the air excessively and consequently causes no appreciable loss in power. However, neither does it give sufficient heat to vaporize more than a relatively small percentage of the fuel, so further modifications in design have been introduced. These consist of additional hotspots placed near the valve pockets or points where the fuel tends to collect, and small heated pockets used in conjunction with baffles, which deflect the liquid fuel into them.

These additional modifications, while they do improve engine performance and to some extent eliminate oil dilution and other evils attendant upon introducing liquid fuel into the cylinders are, nevertheless, only makeshifts at best, because from the viewpoint of maximum performance and economy they are fundamentally wrong.

Hotspots located at the valve pockets and in the manifold branches, even though they should vaporize all the fuel, which they do not, vaporize it only after it has been unequally distributed and thus fail to eliminate one of the chief sources of excessive fuel consumption. The proper time to vaporize all the fuel is before it is distributed. Then there will be no distribution problem.

Any method of carburetion that allows liquid fuel to wet the manifold walls is essentially wrong from the standpoint of maximum economy, no matter how perfectly the fuel may eventually be vaporized. Unless the entire manifold is dry at all loads and speeds, there will always be a loss in fuel economy, due to the fact that the carburetor will have to be set so that normally it will deliver more fuel than is necessary for good economical running. The reason for this may best be shown by describing the changes that take place inside a manifold due to a fluctuating load.

Let us assume the engine to be lightly loaded, a condition favorable to maximum vaporization, because the amount of fuel to be vaporized in unit time is small and the manifold pressure is low, resulting in a low boiling temperature for the fuel. The result is that relatively little liquid exists in the manifold, and its walls will be as nearly dry as they can ever be.

If the throttle is now opened somewhat, due to a demand for more power, the quantity of fuel to be evaporated in unit time is suddenly increased and the manifold pressure is also increased, resulting in a higher fuel boiling temperature. The amount of heat available for vaporizing the fuel is practically the same, for although the exhaust temperature also increases, its effect on the various heating devices lags so far behind that it is of no immediate assistance. Under these circumstances the equilibrium condition previously existing is disturbed, a lesser proportion of the fuel is evaporated, and liquid fuel quickly collects on the manifold walls. If this load condition continues long enough a new equilibrium condition may be attained at which the rate of fuel vaporization and distribution will be equal to the amount of fuel being metered by the carburetor. However, during the time the walls are being wetted, unless some provision has been made for feeding a large excess of fuel, the mixture will be so lean as to cause a large loss in power, or even total failure to ignite. Since the quantity of fuel necessary to wet the walls is much larger than can be supplied by any accelerating well, the only remedy is to set the carburetor to deliver an excess of fuel, so that normally the mixture will be richer than necessary for steady loading, resulting in an inevitable loss in fuel economy.

If now the load decreases, vaporization conditions improve and the fuel on the walls evaporates, making the effective mixture far richer than necessary.

Although these various vaporizing devices might function very well under a condition of constant load, and the carburetor could be set to operate economically, it must necessarily be set for the normal, more severe conditions, of widely fluctuating load, with the results just stated.

Vaporization, Distribution and Economy

The statement that the fuel must be completely vaporized before combustion commences may be further elaborated by adding that this vaporization must take place before the fuel has an opportunity to wet the manifold walls. Even though there were available a carburetor with this advantageous characteristic, it could not successfully be used with our present-day manifolding and vaporizing arrangements. Wet walls and unequal distribution of the manifold liquid make so many demands upon the metering unit, demands which must necessarily be complied with, that its successful operation depends on a large number of compromises, with a resulting large loss in economy. Therefore, the first and most important step that can be taken for increasing the fuel utilization of our modern engines is the redesign of the entire manifolding system so as to evaporate instantly and completely all of the fuel before it is

distributed into the several manifold branches. Obviously, this result should be accomplished without unduly raising the charge temperature.

The good results attained with such a system would not end with decreased fuel consumption. The total vaporization of the fuel would be a long step in the elimination of what are now thought to be the chief troubles of internal combustion engines. Dilution of oil by the liquid fuel, with consequent cylinder and bearing wear, would be entirely eliminated. With the leaner and dryer mixtures used, carbon formations would be greatly reduced. In addition, the engine performance would be materially improved, both as regards smoothness of running, due to more equal power impulses and accelerating ability. It has been proven that the accelerating abilities of an engine depend not upon the metered air-fuel mixture ratio, but upon the actual fuel available for power production at the instant the charge is ignited, which is another way of saying that the fuel must be in a vaporous state. Taken as a whole, vaporization, properly accomplished, has everything in its favor and nothing to be said against it. It would be well if our engine and car designers would take notice of these facts.

Keeping in mind all that has previously been said, let us see in what particulars our present carbureting systems should be changed, so as to more nearly approximate an ideal carbureting structure.

Since the proper operation of the entire carbureting system hinges on the complete and instantaneous vaporization of the fuel, the most important fundamental

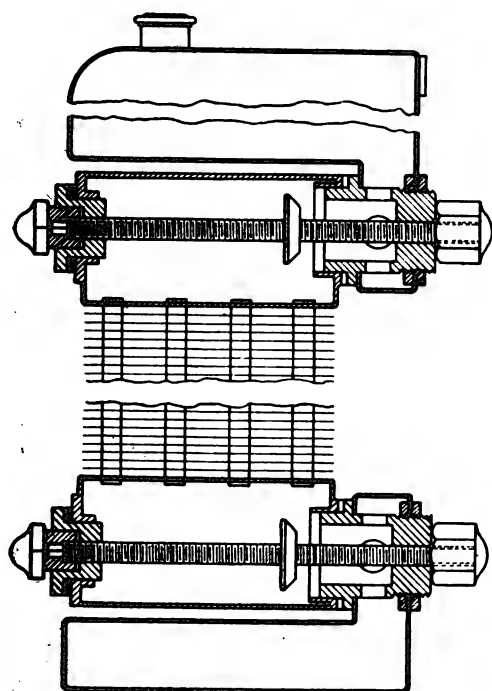
change will be in the means for vaporizing the fuel. This is the crux of the entire matter. There must never be any liquid fuel on the manifold walls. This point cannot be over-emphasized.

Only with the fuel completely vaporized are there no distribution problems, and then only does it become possible to use a carbureter that will meter the fuel to the greatest advantage. Such a carbureter should be designed so that variations in the mixture ratio will be solely dependent upon the change in manifold pressure, which is a direct function of the load carried by the engine. The mixture ratios should be those that would give the highest economy at all loads until nearly maximum manifold pressure is reached, when the ratio should change to give maximum power. There should be a minimum of adjustments on the carbureter so that once this setting is determined for any given engine it should be beyond the power of the operator or any misguided mechanic to alter it. Whatever adjustment is provided should be very weak and influence the metering relations only at idling.

Correction: An error occurred in the last paragraph of the first column p. 667 (Part I of Mr. Golten's article). The portion which was incorrect should read as follows: K is equal to the ratio of the density of the air passing through the throat to the density of the fuel (d_a/d_f) and is included so that the metering head (h), or force which causes the fuel to flow, can be expressed in terms of height of fuel column.

New Sectional Radiator Design

THE Avios radiator, herewith illustrated, is a new sectional type developed in France by M. L. Chardard, and which has been brought to this country by the Framerican Industrial Development Corp. The new principles involved have to do with the method of joining the sections to the top and bottom tanks and can be applied to radiators of any outside form and of any type of core element.



Cross section of Avios radiator

One advantage of the Avios design is that any section can be quickly put out of action, so that if a part of the radiator core becomes injured it does not incapacitate the entire radiator. A spare section or tube can be substituted for an injured one practically without loss of water, and, incidentally, the rate of flow through the core sections can be throttled and thus the rate of circulation be changed at will.

The vertical core elements are provided at both top and bottom with a header, and these headers are secured to the top and bottom tanks in a suitable manner. A nipple is soldered into the header at one side, and this nipple passes through holes in the opposite walls of a downward extension of the top tank and an upward extension of the bottom tank, both extensions being on the rear side of the tanks and of small depth in the fore and aft direction. On the outer, threaded end of this nipple there are two flat nuts between which the rear wall of the tank extension is clamped.

A threaded rod passing centrally through the header serves to clamp the core element to the tank. Each rod has a valve disk soldered to it. By turning the rod, by means of a nut serving as bolt head, the valve disk can be brought up against the end of the nipple so as to close its outlet. The valve disk has a conical seat, which is brought up against the sharp edge of the nipple, so that even if there should be scale on the valve the outlet of the nipple will be closed up tight, it is claimed. After the injured section has thus been shut off it may be removed and replaced by a spare section, whereupon the valves at top and bottom are opened again, which completes the repair. It is thus not necessary to drain the radiator to substitute the spare section for the injured one. If no spare section is carried the car, of course, can be operated with one radiator section missing until a spare can be procured.

Expediting Body Finish Operations by Use of Drying Equipment

A description of modern facilities for decreasing the time and space required to finish automobile bodies. Use of cleaned, heated and humidified air is said to give more uniform and satisfactory finish than does a greater number of coats with natural drying. Time schedules are given in detail.

By J. Edward Schipper

AUTOMOBILE manufacturers are becoming increasingly interested in methods for reducing the amount of time required for bodies in process. It has been realized for a long time that it is one of the fundamental requirements of quantity production that a piece of work move continuously from the time it starts to be fabricated until it is completed. It has been possible to do this in the chassis, but in the bodies, particularly in painting operations, long pauses between different operations are required because of the necessity for using siccative coats, which require time for the evaporation and oxidation process which must be gone through to achieve what is generally known as drying.

Considerable study has been given by a number of concerns to methods which will shorten the drying period, or in other ways reduce the length of time required for the body to have the painting and trimming operations completed. A very radical change in practice which has made possible to materially shorten this time is the discovery that it is possible to make as good if not a better paint job with a considerably less number of coats than was formerly thought essential. This multi-coat idea is one of the direct descendants of carriage builders' traditions. Ten years ago, thirty-five to forty coats were not exceptional for high-grade work. To-day thirteen well selected and properly applied and riage builders' traditions. Ten years ago, thirty-five to

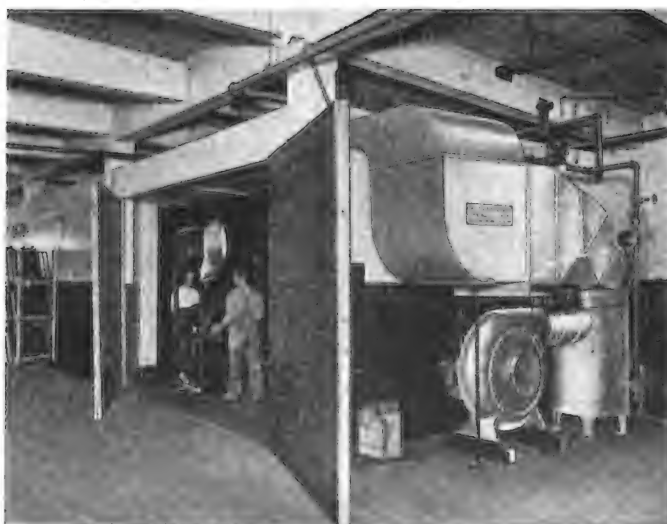
Another way in which the number of bodies and, consequently, the amount of money tied up in bodies in process can be reduced is in the use of methods for more rapidly drying the various coats. The importance of this increased speed in drying may be realized if a concern making 50 bodies to-day may be taken as an example. Assuming the average time for painting without artificial drying is 24 days and the average value of the body during this period is \$300, the space necessary for painting and drying would then be that required for 1200 bodies in which would be tied up the sum of \$360,000, the interest on which at 6 per cent for 24 days is \$1,420. If this time can be

cut in half by the introduction of a modern drying system, both the floor space and the interest on investment in bodies would be half in the saving, and interest alone would be nearly 60 cents per body. To this must be added the interest on capital invested in plants, which will, in the latter case, of course, include the drying, and from this must be deducted or added any increase or saving in operating cost.

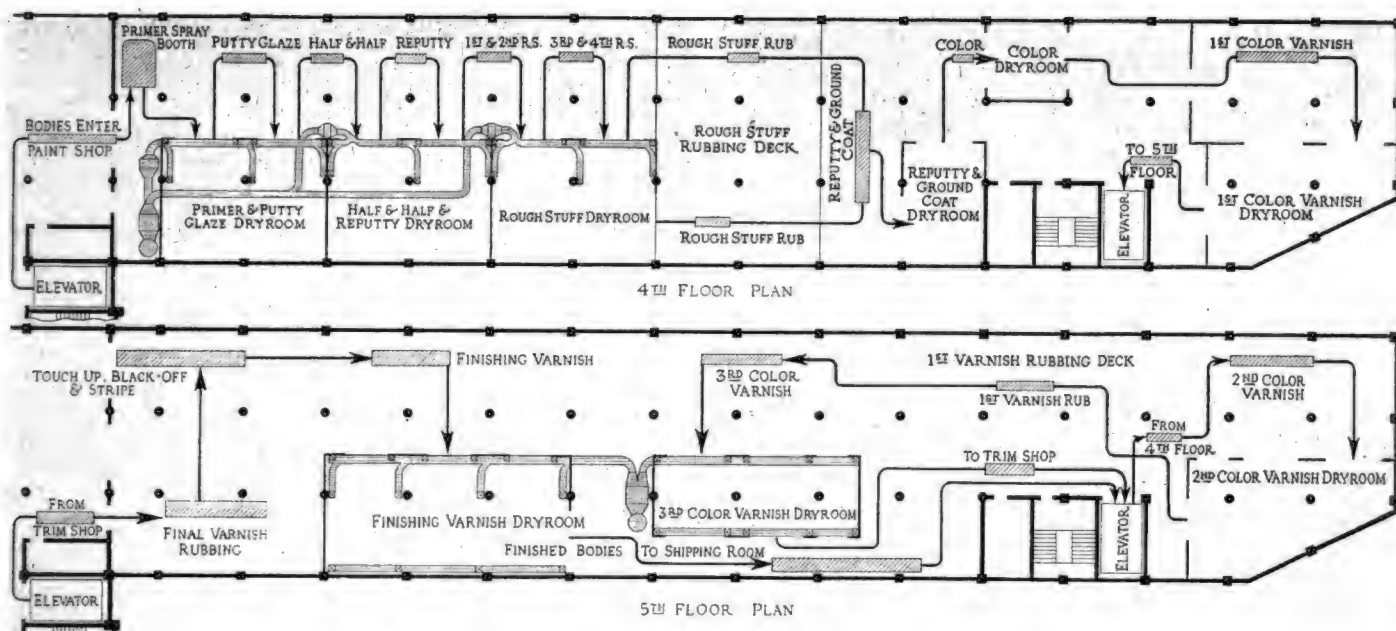
That there is a considerable net saving is evidenced by the fact that drying systems are being extensively used and are being adopted in an increasing measure both by body and car manufacturers. This is not confined to manufacturers in any price class, but is to be found from the highest to the lowest. The principle, of course, finds its maximum economy in the case of the all-metal bodies where a thin but durable finish can be successfully baked on at high temperatures. Even with the metal body built over a wood frame, however, in which the paint coats cannot be baked at such a high temperature, it has been found possible to completely finish and trim, using a standard twelve coat schedule in 4½ working days.

One of the concerns responsible for a number of successful installations of this character is Drying Systems, Inc. The equipment made by this concern is designed to duplicate ideal drying conditions. It is a well-known fact that drying time varies with atmospheric condition. The spring and fall of the year have been known among carriage builders for decades to be the best time in which to paint a carriage which is to be dried under best atmospheric conditions, and the warm summer months have been generally regarded as the worst period. If it is possible to duplicate ideal drying conditions in the drying ovens or drying room at all times, the element of chance is largely eliminated and a greater uniformity as well as rapidity in results will be obtained.

It is essential to remember that the term, drying of siccative coating, is really a misnomer. Such coatings do not dry, but oxidize. What is called the drying action is



Ovens used at the Franklin plant for paint drying. Apparatus for cleaning, heating, humidifying and circulating the air, supplied by Drying Systems, Inc. is seen at the right



A suggested layout for a paint shop using a progressive system of painting and trimming

really a chemical reaction having two periods. During the first period the volatile solvents are evaporated and during the second there is the chemical reaction of oxidation of the oils. (These oils are transformed chemically into oxides which are solid as compared with the more or less liquid form of the coat when first applied.) It has been found that the presence of moisture in the air is necessary for the oxidation or so-called drying of the coat. Furthermore, there are different ideal atmospheric conditions for each kind of coating and for different colors, while for different colors it may be necessary to have different degrees of temperature and per cent of humidity in the air. Experimentation on these subjects is by no means complete, but a great deal has been learned about them and it is possible to apply the knowledge so gained in commercial work to the extent of being able to greatly accelerate the drying of the various coats.

Moisture Essential

Probably the most difficult point for the average layman and often even the experienced finishing foreman to grasp is that moisture in the air is essential to drying. The theory of the value of the moisture content is that the moisture acts as a catalytic agent and co-operates with the increased heat in performing the chemical reaction of oxidation. The drying equipment is designed to duplicate the ideal conditions of temperature and humidity for various kinds and colors of paints. The advantages claimed for the process outside of the shortening of the drying period and consequently the reduction of the number of cars in process are the consequent reduction in the amount of floor space required to finish a definite number of jobs per unit of time, and the ability to turn out a product with an unvarying color standard.

In the drying of automobile bodies it is essential that the primer, lead and rough stuff coatings receive the same careful treatment accorded to the varnishes, since the strength and durability of the final finish depends entirely on the proper drying of the under coatings. In other words, the job has to be engineered from the ground up. It is just as important that the under coatings be uniform and of proper elasticity as the under coatings, because the failure of a under coating invariably means the breaking down of the exterior finish.

In the best installations of a drying system, the under

coat and color varnish operations are generally conducted in the dry rooms of a compartment type located in close proximity to the spray booth. The size and numbers of the dry rooms and ovens, of course, depend on the production requirements. In the case of touring car bodies where it is necessary to rush a large number of bodies through a small space, a material saving can be made in the dry room space by up-ending the bodies in the under coat and color varnish dry rooms. It is claimed that with a properly installed drying system this can be done in perfect safety in the under coat and color varnish dry room. On a production job the schedule for under coat and color varnish drying periods would approximate: Primer, 2 to 5 hr.; lead, 2 to 5 hr.; rough stuff, 2 to 3 hr.; flat color, 1 to 1½ hr.; color rubbing varnish, 3 to 5 hr.

Enclosed Bodies

Enclosed bodies require a relatively longer time because of the great amount of woodwork and it is possible, of course, to use a somewhat higher temperature and consequently to increase the speed of drying on all metal touring car bodies.

The drying equipment furnished by Drying Systems, Inc., consists of a fan, radiator, air washer, humidifier, automatic temperature control, automatic humidity control, steam and water piping. The atmospheric air is brought out and put through the washer, which removes the dirt and humidifies the air. The heat is imparted to the air by cast iron radiators for pressures up to 30 lb. and specially designed pipe coil radiators for higher pressures. Automatic thermostatic temperature control and automatic humidity control is employed and with the installation there is a system of supply and vent ducts to produce the correct circulation of air in the drying room or oven. This is necessary to insure uniform and rapid drying in all parts of the dry room. Closed bodies are usually placed horizontally, while the open bodies are placed vertically and up-ended so as to give space in each oven for as many bodies as possible.

In chassis work the ovens can be installed along the production line so that the chassis pass through the oven on the regular assembly chain. Such an installation is shown in one of the accompanying cuts.

As regards the best layout for a paint shop, it is impossible to give an ideal condition, as so much depends on



Oven installation at the Chalmers plant for drying paint on the chassis as it progresses along the assembly line

the quantity of the product which is going through. The bodies, of course, would first receive their cleaning up and priming coats, then probably a coat of lead, then a glaze and putty, the various rough stuff coats and, after that, the various color varnish and finish coats. The most efficient way of handling this is to have the bodies progressing on toward the finishing room, as each of these steps take place, so that bodies are coming out of one oven and passing on to the next, then on to the next series of operations in a following oven, and eventually to the finishing room. Whether or not bodies go back into the same oven depends upon the quantity of work going through and the space available. Some diagrams of proposed paint shop layouts are given herewith and they are deserving of study as good examples of what can be done to make the paint and trim work a real progressive job.

With the large number of operations on some of the higher priced jobs, the best possible speed that can be obtained is 11 days, not counting the time for trimming. Before the introduction of drying equipment, it would take from 22 to 30 days to do this same work. Lower priced cars do not have a finishing schedule nearly as long as the high grade varnishes, as, for instance, on large production schedules, it is generally the practice to put on a priming coat, lead coat, putty coat, lead coat, two coats of rough stuff which are then water rubbed, a ground color coat, two color varnish coats which are water rubbed, and a stripe, black off and finishing coat.

In still lower priced cars where quantity production is of the utmost importance and where high quality in finish is more or less a secondary consideration, it is the practice to merely apply a priming coat, lead coat, two rough stuff coats, a ground color coat, two color varnish coats and a finishing coat. Jobs of this nature can be put through in from 4 to 5 days.

Variations

Practically every color varnish used has a different temperature and humidity at which it dries best. Green jobs, paint men say, will stand relatively high temperatures in the neighborhood of 150 to 200 deg., light blues and whites,

which are very delicate, will not stand temperatures in excess of 140 deg. Black enamel jobs, such as those used on Dodge and Willys-Overland cars, are three-coated and baked from 35 min. to 1 hr. at from 425 to 450 deg. These are known as enamel jobs and the finish is relatively inexpensive, but the high temperature baking and the quick drying time resulting therefrom cannot be carried out except with black colors.

The proper laying out of the paint job for efficient operation is of tremendous importance to a manufacturer of any product which has to be painted and delivered to the purchaser with a high grade finish. It is possible to spend a great deal of money in this department of manufacture and then achieve only mediocre results. On the other hand, by a careful analysis of the problem, it is possible to secure highly satisfactory results at a minimum expense and even save a considerable amount of money on the parts tied up in process in this department. When it is possible to cut a schedule from 22 days down to 11 days the money represented by the saving is considerable.

Schedules of Operation

The appended tables show the time required, temperature, humidity, etc., for drying the various coats given under the schedules used by manufacturers of cars in different price classes.

MEDIUM PRICED CARS

For colors such as green, which will stand temperature from 160 deg. to 180 deg.

Prime and lead coat.....	1 day
Putty, first and second R. S.....	1 day
Oil, sand, ground color.....	1 day
First and second color varnish.....	1 day
Water rub and trim.....	1 day
Finish	1 day

LOW PRICED CARS

(Fast Schedule)

Prime coat	3 hr.	3 hr.
Lead	2 hr.	2 hr.
First and second R. S..... each	1½ hr.	3 hr.
First and second color varnish..... each	1½ hr.	3 hr.
Finish	6 hr.	6 hr.

Total time from prime to finish, including trim, 3½ days.

On all of these fast schedules the drying is accomplished by means of air washing and humidifying equipment in which is employed a very large volume of air, as otherwise if it is attempted to do it with an equipment in which there is only the normal rate of air change, the coating will surface harden.

The relative humidity at temperatures of 160 deg. to 200 deg. runs in the neighborhood of 22 per cent to 30 per cent, whereas from 160 deg. to 120 deg. it runs from 30 per cent to 45 per cent, but the actual amount of moisture in the air for these higher temperatures is very great, otherwise the surface would case harden almost immediately by coming in contact with the large volume of extremely warm air.

DRYING SCHEDULE OF HIGH GRADE CAR

Prime	Sealer coat,
Lead 1 day	color coat 1 day
Putty glaze,	Egg shell,
First R. S. 1 day	First C. V.,
Second R. S.,	Second C. V. 2 days
Third R. S. 1 day	Rub,
Fourth R. S.,	Third C. V.,
Fifth R. S. 1 day	Rub 2 days
Rub out,	Black off,
Ground coat 1 day	Finish 1 day

This is an 11-day schedule without including time for trimming. The temperature, humidity, and drying time are as follows:

	Temperature, Degrees	Humidity, Per Cent	Drying Time
Prime	120-130	30-35	4-6 hr.
Lead	120-130	30-35	4-6
Putty glaze	120-130	30-35	3-6

	Temperature, Degrees	Humidity, Per Cent	Drying Time
First R. S.	120-130	30-35	3-5 hr.
Second R. S.	120-130	30-35	3-5
Third R. S.	120-130	30-35	3-5
Fourth R. S.	120-130	30-35	3-5
Fifth R. S.	120-130	30-35	3-5
Ground coat	125-130	30-35	2-4
Sealer coat	125-130	30-35	3-5
Color coat	125-130	30-35	2-4
Egg shell	125-130	30-35	3-5
First C. V.	120	37-42	4-6
Second C. V.	120	37-42	4-6
Third C. V.	120	37-42	4-6
Black off and stripe	110	40-45	2-4
Finish varnish	100-104	45-50	10 hr. or overnight

SCHEDULE FOR VERY HIGH GRADE WORK

	Temperature, Degrees	Humidity, Per Cent	Drying Time
Prime	120-125	30-35	8 hr.
Half and half	120-125	30-35	8 hr.
Putty coat	120-125	30-35	4-5
First R. S.	115-120	35-40	4-5
Second R. S.	115-120	35-40	4-5
Third R. S.	115-120	35-40	4-5
Fourth R. S.	115-120	35-40	4-5
Preparation coat	115-115	35-40	3-4
Color coat	110-115	35-40	3-4
First C. V.	100-105	40-45	8
Second C. V.	100-105	40-45	8
Third C. V.	100-105	40-45	8
Finish Varn.	90-90	45-50	24

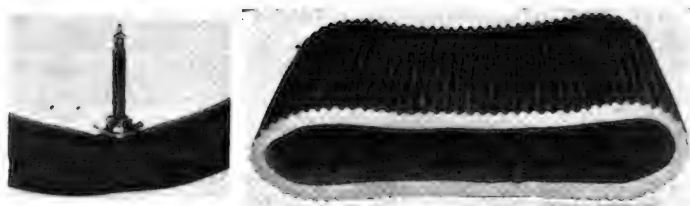
There is a rubbing operation between the second and third color varnish coats and also after the third color varnish coat.

New Tube Has No Splice

A NEW tube having a corrugated outer surface moulded in one piece without splice is shortly to be marketed through the Edward A. Cassidy Co., Inc. It will be manufactured under Fairchild patents by the Corrugated Rubber Corp.

The corrugated inner tube is moulded in a ring of oval cross-section, without splices, seams or creases. The valve is vulcanized directly into this ring and thoroughly reinforced. Circumferential corrugations maintain air spaces between the tube and the casing, and are said to prevent overheating and freezing of the tube to the casing. The tube is so made that it floats free from the rim before inflation, preventing pinching. No vulcanizing accelerators are used in its production. Corrugated tubes are said to require only five operations in manufacture. Extra heavy red antimony rubber is used. All tubes are made to conform to Government specifications covering thickness of wall, tensile strength and elastic limit.

In manufacturing the rubber is first broken down, made soft, and compounded with antimony. It is then put through a tubing machine, adjustable as to size and wall thickness. It is then in plastic form, but firm enough to be easily handled and shaped. It is cut to length, bent in a circle and formed. Valve, inner ring and base patch are inserted from inside of tube, the ends are then joined and kneaded together and the outer base patch added. The tube, now completely formed while the rubber is soft, is placed in a vulcanizing mold and as heat is applied to the outside hot vulcanizing gas under high pressure, is automatically applied to the inside of tube. The pressure forces the rubber against the surface of the mold, thus forming the tube to the desired shape. The



Sectional and side views of the corrugated tube molded without splice

vulcanization is said to require but twenty minutes as against seventy minutes with old processes. The mold is then opened and the finished tube removed.

THE Gloucestershire Aircraft Company, Limited, has completed a design for a cargo-carrying machine of high capacity.

"This is a tractor-biplane fitted with a Rolls-Royce 'Eagle' engine. The wings of the upper plane are larger in area and thicker in section than those of the lower plane, and the petrol tanks are fitted inside them. The fuselage of the machine is in three sections. The leading one takes the engine, the middle one the cabin, and the rear one, which carries the tail and skid, is hinged on to the cabin section, so that it can be turned at right angles to the rest of the fuselage. By this means cargo can be taken aboard with great ease. By means of a gangway hinged to the cabin floor loading trolleys can be wheeled right into the aeroplane.

The machine has a goods load of 1600 lb. Its ceiling is 14,000 ft., and its air endurance is four hours and three-quarters at a cruising speed of 92 miles an hour."

State Regulation of State Motor Vehicle Common Carriers

Motor vehicles which are classed as common carriers have been subject to State regulation during recent years. This article gives a detailed survey of the regulations now in force, together with a critical analysis of the character of State control. Facts concern automotive manufacturers.

By Harry Meixell.*

UNTIL a few years ago the legislatures of our forty-eight States in no way differentiated between these various uses of the motor vehicle in the laws which they enacted dealing with operating requirements, registration fees and the many other subjects which are usually found in a State's motor vehicle laws.

In 1914, however, Pennsylvania definitely segregated motor vehicles when used as common carriers and placed them under the regulation of the State's Public Service Commission. To-day the laws of twenty-two States provide for a greater or less degree of such State control.

On following pages is a tabulation setting forth a digest of the more important matters which through the year 1921 had been made the subject of those State laws specifically enacted to bring motor vehicle common carriers under State control and regulation. This tabulation should be carefully considered in connection with the following discussion of the data which it contains.

Without exception State regulation of motor vehicle common carriers has been vested by law in pre-existing State agencies that exercise control over other forms of common carriers such as railroads, trolleys, telephone and telegraph lines, pipe lines, etc. The third column of the tabulation shows that these agencies have consisted of State Public Utilities or Public Service Commissions, Railroad Commissions, the Commerce Commission as in the case of Illinois, the State Tax Commission of Alabama, the Arizona Corporation Commission, or even the State Road Commission as in West Virginia.

In some instances these pre-existing State agencies have assumed control over motor vehicle common carriers by virtue of the broad general powers of the law establishing the Commissions.

In its broadest conception a motor vehicle common carrier is one that passes any and everywhere over the highways, indiscriminately transporting for a consideration all persons who present themselves as passengers or carrying all commodities or classes of commodities offered. Obviously this involves interstate transportation. The Federal Interstate Commerce Act takes no specific cognizance of the matter, however, so the application of control by the various States is in no way guided or modified by Federal laws on the subject.

A few States deal with the subject merely from the standpoint of local control, the incorporated municipalities being given power by the State Legislature to require motor vehicle common carriers to obtain permission and

a license for the purpose from the local governing body. This is the case in Massachusetts, where the Board of Selectmen or City Council exercise control over motor vehicle common carriers transporting passengers.

As for State control this expresses itself in two ways: On the one hand there is a State law whose provisions give to some State agency broad general powers of control over motor vehicle common carriers. On the other hand, for the execution of these powers, the agency is permitted to promulgate and enforce such rules and regulations as it may deem necessary, express stipulation being made in some of the State laws on the subject that these rules and regulations shall take precedence over municipal ordinances.

The various laws establishing and defining this State control have in many cases, however, greatly narrowed its application. For instance, while most of the States which have dealt with the subject allow their respective State agencies to regulate both passenger and property transportation by motor vehicle common carriers, Alabama, Connecticut, Maine, New Hampshire and others limit this power to passenger transportation only.

Then, again, while most of the regulating States apply their powers of control to carriers operating within, into, and out from the limits of incorporated municipalities, California, Ohio and Oregon merely exercise authority over such transportation as is not confined solely to the limits of a city, town or other similar form of incorporated municipality.

As another and final illustration most State laws regulating motor vehicle common carriers narrow the scope of such control to vehicles operating "between fixed termini or over a regular route." In the Arizona law this expression is defined to mean the termini between which or the route over which a carrier usually or ordinarily operates his motor vehicle, "even though there may be departures from said termini or route, whether such departures be periodic or irregular." As a rule it is made a question of fact for the State agency exercising control to determine if the carrier is operating "between fixed termini or over a regular route."

With very few exceptions the powers wielded by the Public Service Commissions or similar forms of State agencies over common carrier transportation by motor vehicles are extremely numerous and broad. A consultation of the chart shows that these powers can be listed as follows:

- (1) Grant, refuse to grant, amend or revoke Certificates of Public Convenience and Necessity.
- (2) Prescribe routes.
- (3) Fix schedules.

*Secretary of the Motor Vehicle Conference Committee of the American Automobile Association, Motor and Accessory Manufacturers' Association, National Automobile Chamber of Commerce, National Auto Dealers' Association, Rubber Association of America and Trailer Manufacturers' Association of America.

- (4) Determine character of service and promote the comfort and safety of traveling public.
- (5) Establish fares and rates.
- (6) Require reports and uniform methods of accounting.
- (7) Examine accounts and records.
- (8) Supervise fiscal affairs such as incorporation, capitalization of stock, etc.
- (9) Compel additions to, extensions of or betterments in physical equipment.

It is apparent that these powers are practically unlimited and of such a nature that the State agency has almost absolute control over the life or death of motor transportation within its jurisdiction. Nevertheless all of the rulings of the various commissions are subject to review by the proper courts and aggrieved parties can easily and freely appeal to them for redress of wrongs or supposed wrongs.

Furthermore, in the all-important matter of Certificates of Public Convenience and Necessity, decisions are usually made contingent on public hearings at which applicants for such certificates, other agencies of transportation serving the same territory and the general public are given full opportunity to present facts and opinions on the subject.

Up to this point in the discussion the entire subject has been approached from the standpoint of the State's power. It is now desirable to look at the question from the side of the operator of a motor vehicle common carrier, especially to learn what steps he must take in order, either to stay in business after a State adopts the policy of regulation or enter the business anew.

In a few States, as New Hampshire, for instance, it is only necessary for the operator to obtain a permit from the State authority. This is the rare exception, however, rather than the rule. In nearly every other State a Certificate of Public Convenience and Necessity is required; while in Colorado, New York and Wisconsin a permit from the governing bodies of the municipalities in which the common carrier seeks to operate must also be secured.

In several States motor vehicle common carriers established at the time the law first went into effect have been expressly exempted from this requirement making it necessary for none but operators beginning business after the passage of the law to obtain Certificates of Public Convenience and Necessity. In Connecticut, however, and in general in every other State, established, as well as new motor vehicle common carriers, have been obliged to demonstrate to the State agency their right to exist after the State control act has been written into the statute books. Obviously, this has very often meant real hardship to those who have invested substantial sums of money in motor vehicles and have built up paying businesses over certain routes only to be obliged to abandon everything under State regulations.

Another usual prerequisite to the operation of motor vehicle common carriers has been the necessity of taking out indemnity bonds for the payment of any claims that may arise from any injury caused to persons or damage done to property by the carrier. In general the conditions of these indemnity bonds and sometimes their amounts are left to

the State agency to determine. Frequently, however, the amounts are fixed by law as in Washington, where \$5,000 to \$10,000 is prescribed for indemnification of claims arising from injury to persons and \$1,000 for damage to property.

While in the imposition of annual registration fees and other forms of taxes upon motor vehicles, State legislatures have in only a few cases discriminated between motor vehicle common carriers and private carriers, nevertheless, they have drawn a sharp line between motor vehicles used privately by their owners and those operated for hire.

Any discussion of State regulation of the motor vehicle when used as a common carrier would be incomplete without reference to the arguments for and against such regulation. In so doing, however, the opinion frequently expressed that railroad and trolley companies, as a result of the severe competition of motor transportation, are seeking State regulation as a means of killing off such competition, will be totally disregarded, and only such arguments recorded as are predicated on public welfare, sound economics and strict impartiality.

With these premises, therefore, those who contend for State regulation say that such control is necessary:

(1) Because motor transportation for hire is a public utility, and as such should be regulated along with other public vehicles, so that travelers and shippers by such means can be made sure of safe, prompt, regular, adequate, efficient and economical service.

(2) So that, in all cases where motor vehicle common carriers come, or are likely to come, in ruinous competition with other common carriers, the State can step in and determine whether public convenience and necessity require

such competition, and save, if desirable, the pre-existing agencies of transportation.

(3) In order to shoulder upon the motor vehicle common carrier obligations, financial and otherwise, in return for the rights given it to operate for a profit over all or certain highways within a State especially so since the highways are built and maintained by the public. In some cases these rights take the form of valuable franchises which virtually grant monopolistic privileges over certain routes.

(4) For the purpose of eliminating the irresponsible, so-called "fly-by-night" companies and individuals who, while undergoing certain destruction for themselves, pull down with the ruin well managed motor transportation agencies which render a real public service and are entitled to a reasonable return on their investments and a stabilization of their business.

In objection to these arguments for State regulation of the motor vehicle common carrier, opponents of the proposition maintain:

(1) That granted motor transportation for hire is a public utility, public interest can best be served by unrestricted competition and complete freedom from regulation in which none but the fittest can survive. This policy they contend will yield to passengers and shippers the maximum of results with the minimum of cost.

They deny any analogy between motor vehicle common carriers and railroad and trolley transportation agencies, pointing out that the latter by virtue of private owner-

THE motive of this discussion of State regulation of motor vehicles used for hire is for information only. It is not intended as favoring either one side or the other of the question. The Motor Vehicle Conference Committee will appreciate any comments or arguments pro and con that readers of the article may care to advance. The purpose of the article is to lay before those interested facts and arguments which will facilitate the passage of only such laws as are scientifically correct and fair to all concerned.

Summary of Salient Features of State Laws Regulating Motor Vehicle Common Carriers

State	Law in Effect	State Agency Exercising Control	Application of Control	Prerequisites of Operation	General Powers of State Agency, Etc.	Special or Extra State Taxes
Alabama	1919	State Tax Commission.	Passenger transportation only. Within, out from and into municipalities.	Filing of written statement showing terminal points of routes to be covered. Obtaining of special license.		In lieu of regular registration fees, the following: Seating capacity 5 passengers or less, \$37.50 Seating capacity over 5 passengers, less than 10, 60.00 Seating capacity over 10 passengers, 90.00
Arizona	1919	Corporation Commission.	Passenger and property transportation. Within, out from and into municipalities.	Certificate of Public Convenience and Necessity. Indemnity bond as conditioned by Commission.	General control over granting of Certificate of Public Convenience and Necessity; regulating service; fixing rates and fares.	
Arkansas	1917	Railroad Commission.	Passenger and property transportation. Out from and into municipalities only.	Certificate of Public Convenience and Necessity.	Grant, refuse, suspend, revoke or amend Certificates of Public Convenience and Necessity; prescribe service or extensions thereof; fix rates and fares, supervise fiscal affairs; authorize sale or lease of certificates.	
California					Wide control over issuance of Certificates of Public Convenience and Necessity; prescribe service or extensions thereof; fix rates and fares; promote health, safety and convenience of operation. Municipalities may purchase and operate motor vehicle common carriers.	
Colorado	1915	Public Utilities Commission.	Passenger and property transportation. Within, out from and into municipalities.	Permission from municipalities to operate. Certificate of Public Convenience and Necessity.	Grant or withhold Certificate of Public Convenience and Necessity. Street railroad companies may acquire, own and operate motor vehicles for hire.	Special registration fees for passenger carrying motor vehicle: Seating 9 passengers or less, \$20; for each additional seat of capacity, \$1.
Connecticut	1921	Public Utilities Commission.	Passenger transportation only. Within, out from and into municipalities.	Certificate of Public Convenience and Necessity. Indemnity insurance based on seating capacity: range \$5,000 to \$10,000 per vehicle.		Extra registration fees as follows: Regular fee plus \$15 for vehicle with seating capacity of 5 or less; over 5 but under 21, \$2 per seat over 5; 21 but under 41, \$5 per seat over 20; 41 or over, \$10 per seat over 40.
Delaware						
Florida						
Georgia	1907	Railroad Commission.			The Commission holds that it has jurisdiction over motor vehicle common carriers, but has not as yet had occasion to exercise this power.	Special registration fees: For passenger carrying vehicle: seating capacity 7 or less, \$5 per seat; over 7 but less than 17, \$7.50 per seat; 17 or over, \$10 per seat in addition to 75c per 100 lbs. gross weight of vehicle and load. For property carrying vehicles, \$1.50 per 100 lbs. gross weight on pneumatic tires; \$2.25 per 100 lbs. on solid tires.
Idaho						Special registration fees for passenger carrying vehicles with a seating capacity of ten or more, \$75.
Illinois	1921	Commerce Commission.	Passenger and property transportation. Within, out from and into municipalities.	Certificate of Public Convenience and Necessity. Adequate indemnity insurance or sworn statement of ability to meet any possible damage claims.	Grant, refuse, alter, modify Certificates of Public Convenience and Necessity. Regulate rates, fares, service, contracts, practices, etc.	Extra state tax on property carrying vehicles not operated exclusively within a municipality. Gross weight 12,000 lbs. or less, 1c per mile; over 12,000 lbs., 2c per mile. On passenger carrying vehicles gross weight 12,000 lbs. or less, 1/15c; over 12,000 but not more than 15,000 lbs., 1/8c; over 15,000 lbs., 1/4c per mile.
Indiana						
Iowa						
Kansas						
Kentucky						
Louisiana						
Maine	1921	Public Utilities Commission.	Passenger transportation only. Within, out from and into municipalities.	Certificate of Permission.	Make rules and regulations governing operation; fix fares, regulate routes and schedules, etc.	Extra State Registration fee amounting to double normal fee.
Maryland	1916	Public Service Commission.	Passenger and property transportation. Within, out from and into municipalities.	Annual permit.	Grant, or refuse permits. Make rules and regulations governing operation. Fix rates, fares, schedules, etc. Provide for safety and convenience of traveling and shipping public.	
Massachusetts						
Michigan						
Minnesota						
Mississippi						
Missouri						
Montana						
Nebraska	1919	State Railway Commission.	Commission has only asserted jurisdiction over property transportation out from and into municipalities.		Commission in 1919 issued an order affecting rates and classifications of property carried by motor vehicle common carriers out from and into municipalities. Order rescinded in 1921.	25% extra registration fee for property carrying motor vehicles and passenger carrying motor vehicles seating more than seven passengers.

State	Law in Effect	State Agency Exercising Control	Application of Control	Prerequisites of Operation	General Powers of State Agency, Etc.	Special or Extra State Taxes
Nevada	1919	Public Service Commission.	Passenger and property transportation, within, out from and into municipalities.	Certificate of Public Convenience and Necessity. Indemnity bond not less than \$500 nor more than \$10,000 per vehicle.	Issued or withhold Certificate of Public Convenience and Necessity. Regulate fares, rates, schedules, classifications. Examine books and records; prescribe service; order improvements, additions, etc.	Extra annual tax of \$2 per 100 pounds gross weight for operating on first class highways. \$1 per 100 pounds on second class; 25c per 100 pounds on other than 1st and 2nd class.
New Hampshire	1919	Public Service Commission.	Passenger transportation only. Within, out from and into municipalities.	Permit to operate. Indemnity bond of \$500 per vehicle plus \$100 per person of seating capacity.	Grant or refuse permits. Establish reasonable rules and regulations governing operation.	Special registration fees as follows: 5 passenger or less; \$15; 6 to 8 persons, \$17.50; 9 to 12 passengers, \$20; 13 to 17 passengers, \$25; 18 to 22 passengers, \$30; 23 to 26 passengers, \$35; 27 to 30 passengers, \$40; over 30 passengers, \$40; plus \$2 per seat in excess of 30.
New Jersey	1921	Board of Public Utilities.	Passenger transportation only and solely where it parallels street railway lines. Within, out from and into municipalities. Only applicable to lines established after March 15, 1921.	Indemnity bond of \$5,000 by municipalities in which lines operate.	General supervision, regulation and jurisdiction in the matter of rates, fares, schedules, service, etc.	Special registration fees as follows: 5 passenger or less; \$15; 6 to 8 persons, \$17.50; 9 to 12 passengers, \$20; 13 to 17 passengers, \$25; 18 to 22 passengers, \$30; 23 to 26 passengers, \$35; 27 to 30 passengers, \$40; over 30 passengers, \$40; plus \$2 per seat in excess of 30.
New Mexico	1915	Public Service Commission.	Passenger transportation only. Within, out from and into municipalities.	Consent of municipal authorities. Certificate of Public Convenience and Necessity. Indemnity bond as conditioned by the local authorities.	General jurisdiction over rates, fares, schedules, service, etc.	Special registration fees as follows: 5 passenger or less; \$15; 6 to 8 persons, \$17.50; 9 to 12 passengers, \$20; 13 to 17 passengers, \$25; 18 to 22 passengers, \$30; 23 to 26 passengers, \$35; 27 to 30 passengers, \$40; over 30 passengers, \$40; plus \$2 per seat in excess of 30.
New York	1915	Public Service Commission.	Passenger transportation only. Within, out from and into municipalities.	Consent of municipal authorities. Certificate of Public Convenience and Necessity. Indemnity bond as conditioned by the local authorities.	General jurisdiction over rates, fares, schedules, service, etc.	Special registration fees as follows: 5 passenger or less; \$15; 6 to 8 persons, \$17.50; 9 to 12 passengers, \$20; 13 to 17 passengers, \$25; 18 to 22 passengers, \$30; 23 to 26 passengers, \$35; 27 to 30 passengers, \$40; over 30 passengers, \$40; plus \$2 per seat in excess of 30.
North Carolina	1919	Board of Railroad Commissioners.	Passenger and property transportation. Within, out from and into municipalities.	Consent of municipal authorities. Certificate of Public Convenience and Necessity. Indemnity bond as conditioned by the local authorities.	Fix and adjust rates, fares, classifications, schedules, etc. Establish uniform accounts. Investigate books, records, methods, etc.	Special registration fees as follows: 5 passenger or less; \$15; 6 to 8 persons, \$17.50; 9 to 12 passengers, \$20; 13 to 17 passengers, \$25; 18 to 22 passengers, \$30; 23 to 26 passengers, \$35; 27 to 30 passengers, \$40; over 30 passengers, \$40; plus \$2 per seat in excess of 30.
North Dakota	1921	Public Service Commission.	Passenger transportation only. Out from and into municipalities only.	Consent of municipal authorities. Certificate of Public Convenience and Necessity. Indemnity bond as conditioned by the local authorities.	Fix and adjust rates, fares, classifications, schedules, etc. Establish uniform accounts. Investigate books, records, methods, etc.	Special registration fees as follows: 5 passenger or less; \$15; 6 to 8 persons, \$17.50; 9 to 12 passengers, \$20; 13 to 17 passengers, \$25; 18 to 22 passengers, \$30; 23 to 26 passengers, \$35; 27 to 30 passengers, \$40; over 30 passengers, \$40; plus \$2 per seat in excess of 30.
Ohio	1921	Public Service Commission.	Passenger transportation only. Out from and into municipalities only.	Consent of municipal authorities. Certificate of Public Convenience and Necessity. Indemnity bond as conditioned by the local authorities.	Fix and adjust rates, fares, classifications, schedules, etc. Establish uniform accounts. Investigate books, records, methods, etc.	Special registration fees as follows: 5 passenger or less; \$15; 6 to 8 persons, \$17.50; 9 to 12 passengers, \$20; 13 to 17 passengers, \$25; 18 to 22 passengers, \$30; 23 to 26 passengers, \$35; 27 to 30 passengers, \$40; over 30 passengers, \$40; plus \$2 per seat in excess of 30.
Oklahoma	1920	Public Service Commission.	Passenger and property transportation. Out from and into municipalities only.	Consent of municipal authorities. Certificate of Public Convenience and Necessity. Indemnity bond as conditioned by the local authorities.	Fix and adjust rates, fares, classifications, schedules, etc. Establish uniform accounts. Investigate books, records, methods, etc.	Special registration fees as follows: 5 passenger or less; \$15; 6 to 8 persons, \$17.50; 9 to 12 passengers, \$20; 13 to 17 passengers, \$25; 18 to 22 passengers, \$30; 23 to 26 passengers, \$35; 27 to 30 passengers, \$40; over 30 passengers, \$40; plus \$2 per seat in excess of 30.
Oregon	1920	Public Service Commission.	Passenger and property transportation. Out from and into municipalities only.	Consent of municipal authorities. Certificate of Public Convenience and Necessity. Indemnity bond as conditioned by the local authorities.	Fix and adjust rates, fares, classifications, schedules, etc. Establish uniform accounts. Investigate books, records, methods, etc.	Special registration fees as follows: 5 passenger or less; \$15; 6 to 8 persons, \$17.50; 9 to 12 passengers, \$20; 13 to 17 passengers, \$25; 18 to 22 passengers, \$30; 23 to 26 passengers, \$35; 27 to 30 passengers, \$40; over 30 passengers, \$40; plus \$2 per seat in excess of 30.
Pennsylvania	1914	Public Service Commission.	Passenger and property transportation. Within, out from and into municipalities.	Certificate of Public Convenience and Necessity.	Grant or refuse Certificates of Public Convenience and Necessity. Regulate rates, fares, schedules, equipment, service, etc. Examine accounts and records. Require reports, uniform accounting methods, etc.	Extra registration fee of 50% over normal fee.
Rhode Island	1918	Public Service Commission.	Passenger and property transportation. Within, out from and into municipalities.	Certificate of Public Convenience and Necessity.	Grant or refuse Certificates of Public Convenience and Necessity. Regulate rates, fares, schedules, equipment, service, etc. Examine accounts and records. Require reports, uniform accounting methods, etc.	Extra registration fee of 50% over normal fee.
South Carolina	1918	Public Service Commission.	Passenger and property transportation. Within, out from and into municipalities.	Certificate of Public Convenience and Necessity.	Grant or refuse Certificates of Public Convenience and Necessity. Regulate rates, fares, schedules, equipment, service, etc. Examine accounts and records. Require reports, uniform accounting methods, etc.	Extra registration fee of 50% over normal fee.
South Dakota	1918	Public Service Commission.	Passenger and property transportation. Within, out from and into municipalities.	Certificate of Public Convenience and Necessity.	Grant or refuse Certificates of Public Convenience and Necessity. Regulate rates, fares, schedules, equipment, service, etc. Examine accounts and records. Require reports, uniform accounting methods, etc.	Extra registration fee of 50% over normal fee.
Tennessee	1918	Public Service Commission.	Passenger and property transportation. Within, out from and into municipalities.	Certificate of Public Convenience and Necessity.	Grant or refuse Certificates of Public Convenience and Necessity. Regulate rates, fares, schedules, equipment, service, etc. Examine accounts and records. Require reports, uniform accounting methods, etc.	Extra registration fee of 50% over normal fee.
Texas	1918	Public Service Commission.	Passenger and property transportation. Within, out from and into municipalities.	Certificate of Public Convenience and Necessity.	Grant or refuse Certificates of Public Convenience and Necessity. Regulate rates, fares, schedules, equipment, service, etc. Examine accounts and records. Require reports, uniform accounting methods, etc.	Extra registration fee of 50% over normal fee.
Utah	1918	Public Service Commission.	Passenger and property transportation. Within, out from and into municipalities.	Certificate of Public Convenience and Necessity.	Grant or refuse Certificates of Public Convenience and Necessity. Regulate rates, fares, schedules, equipment, service, etc. Examine accounts and records. Require reports, uniform accounting methods, etc.	Extra registration fee of 50% over normal fee.
Vermont	1918	Public Service Commission.	Passenger and property transportation. Within, out from and into municipalities.	Certificate of Public Convenience and Necessity.	Grant or refuse Certificates of Public Convenience and Necessity. Regulate rates, fares, schedules, equipment, service, etc. Examine accounts and records. Require reports, uniform accounting methods, etc.	Extra registration fee of 50% over normal fee.
Virginia	1918	Public Service Commission.	Passenger and property transportation. Within, out from and into municipalities.	Certificate of Public Convenience and Necessity.	Grant or refuse Certificates of Public Convenience and Necessity. Regulate rates, fares, schedules, equipment, service, etc. Examine accounts and records. Require reports, uniform accounting methods, etc.	Extra registration fee of 50% over normal fee.
Washington	1921	Department of Public Works.	Passenger and property transportation. Within, out from and into municipalities.	Certificate of Public Convenience and Necessity. Indemnity bond \$5,000 per vehicle for injury to persons; not over \$1,000 for damage to property.	Grant, refuse, suspend, revoke, alter, amend Certificate of Public Convenience and Necessity; fix proper rates, fares, charges, classifications, regulations. Prescribe equipment service and safety of operation. Regulate accounts; require reports, etc.	Extra annual tax of \$5 per vehicle in cities and towns of less than 5000 population; \$10 per vehicle where population is 5000 or over.
West Virginia	1921	State Road Commission.	Passenger and property transportation. Within, out from and into municipalities.	Permit to operate.	Grant permits although no discretionary power is vested in Commission. Classify vehicles and fix their privilege taxes.	Extra annual registration fees: Passenger carriers for vehicles with seating capacity of 8 or less, \$10; 50c per passenger over 8. For property carriers, \$10 for vehicle of 3 tons or less capacity; \$1 per ton of capacity over 3 tons.
Wisconsin	1915	Railroad Commission.	Passenger transportation only. Within, out from and into municipalities.	Consent of Municipality. Indemnity bonds as fixed and approved by the Commission.	Determine adequacy and reasonableness of fares, routes and service. District Attorney authorized to enforce rules laid down by Commission.	For passenger carriers extra registration fee roughly 100% greater than normal annual fees.
Wyoming	1915	Railroad Commission.	Passenger transportation only. Within, out from and into municipalities.	Consent of Municipality. Indemnity bonds as fixed and approved by the Commission.	Determine adequacy and reasonableness of fares, routes and service. District Attorney authorized to enforce rules laid down by Commission.	Special fee for passenger carriers operating wholly within a municipality, \$10 per vehicle which is in lieu of regular fee.

TEXAS

Carrying persons or property for hire between municipalities, \$32 to \$160, plus 1/2c. to 4c. per mile traveled according to net carrying capacity.

MARYLAND

Special fee, \$1.20 per hp.

LOUISIANA

Special registration fee for passenger carriers: 68c. per hp., plus \$2 per passenger up to 8; \$3 per passenger, 8-25; \$5 per passenger over 25.

*Since these tables were made up the following information under "Special or Extra State Taxes" has come in:

ship of franchises, rights of way, road beds, tracks and terminals have an exclusive and monopolistic control over all transportation on their routes. Motor truck operators, on the other hand, even where granted a monopoly of transportation for hire over a certain prescribed highway or portion thereof cannot deny the use of that highway to others who wish for themselves or as private carriers to transport persons or property over those same routes.

Finally, they point out that governmental regulation of rail and trolley common carriers came after these agencies had abused their rights and privileges and through pools, stifling of competition, exorbitant increase of rates, discrimination, stock watering, etc., made it necessary for the public in self-protection to subject them to control. By the very nature of the service these evils are impossible with motor transportation, since the road is free to the use of everyone and motor vehicles the medium for transportation over the roads are quickly, cheaply and in unlimited numbers available for everyone.

(2) Since the obvious outcome of the first argument advanced against State regulation is "cut-throat" competition between various forms of transportation attempting to serve a certain territory and *per se* between the motor transportation companies themselves operating in competition over certain highway routes, the opponents of State regulation cannot escape the query whether they are willing to face the logical consequences of such a struggle. Without hesitation they answer that wherever rail, trolley or any other form of transportation for hire cannot stand up before a newer and better form, public interest demands that it should give way; likewise within that newer and better form of transportation, the rule should be survival of none but the most efficient and economical agencies. They are confident that even though such a policy may mean the destruction at times of more or less invested capital, as it did when rail and inland water transportation first came into acute competition, the final economic benefits to the community as a whole will many times compensate for the loss involved.

(3) As for shouldering upon motor transportation for hire financial and other burdens which it should rightly carry, opponents of State regulation say that legislative bodies have not heretofore found it necessary to establish such control in order to determine the weight limits for motor vehicles used as common carriers; their registration fees and other charges; their liability to the public for injury to persons or damage to property, etc. If this is all that is involved it is not sufficient to warrant almost unlimited regulation in all other respects by a State agency.

(4) Lastly, those against State regulation believe that the natural working out of economic laws will do more to stabilize the motor transportation for hire business than extensive interference on the part of governmental agencies of any sort. They feel that the proposition is paternalistic and will result either in discrimination in favor of one or more types of transportation, and against all the rest, or else that it will promote monopolistic advantages for certain motor transportation companies, and that through it all the traveling and shipping public will pay the cost.

In even-numbered years the activities of State legislatures are relatively light, since no more than eleven or twelve State law-making bodies get together in regular session, while few of the others meet in special session. Notwithstanding this fact 1922 is producing a big crop of bills dealing with motor vehicle common carriers. The Arizona State Legislature now in special session and the current regular sessions of the Maryland, New Jersey and New York State legislatures are considering extensions

of the existing powers of their State agencies exercising control over motor vehicle common carriers. On the other hand, in Kentucky, Massachusetts, Mississippi, Rhode Island, South Carolina and Virginia, where the State legislatures are in regular session, and where as yet there is no such regulation, many measures aiming to bring about a greater or less amount of such control are now receiving the careful consideration of the legislators.

In this connection it is interesting to note that in New Jersey the strongest and most active opponents of State regulation and the extension thereof, have introduced and are striving to bring about exclusive power in the premises for the local incorporated municipalities. Apart from any other arguments pro and con for such local control, it must be apparent that the operation of a motor vehicle common carrier beyond the confines of a single municipal jurisdiction of a State becomes extremely complicated and burdensome under such circumstances and is likely to suffer from the varying policies of constantly shifting local governing bodies.

Another interesting movement to note in some States is proposed legislation to require every common carrier motor vehicle engaged in the transportation of passengers to have both a front and rear entrance, while in Maryland a pending measure would require not only a chauffeur but also a conductor on every such vehicle. This would seem to indicate that some State law-makers seek to rewrite in motor-bus transportation the full crew laws which for a long time have been an economic burden for the railroads.

The motive of this discussion of State regulation of motor vehicles used for hire is informative only. It is not intended and in no way must be regarded as favoring either one side or the other of the question. For this reason the conference committee will appreciate greatly any information; arguments pro and con; comments; corrections or criticisms which all those who read this discussion may have to offer, especially if such material includes the practical experiences that have resulted from regulation by the States where it is now in force. How important this is can be seen from the fact that in 1923 the legislators of forty-two States will meet in regular session and doubtless be called upon to make decisions on scores of bills vital to motor vehicle common carriers. The conference committee hopes at that time to be of service in laying before all concerned facts and arguments which will facilitate the passage of only such laws as are scientifically correct and fair to motor vehicle common carriers; competing common carriers and the public.

IT is doubtless known what effect the Townsend law providing Federal road aid in the United States is having to build up our own highways. Brazil has just approved and adopted a similar law, according to a statement from Ambassador Morgen at Rio de Janeiro, stating that an executive decree on Jan. 11, 1922, made effective the law authorizing federal subsidies up to 50 per cent for the improvement and maintenance of roads and highways. The improvement work will be done by the various states of Brazil, and the federal government will reimburse them by 50 per cent of the cost.

This is probably the most significant step yet taken in any country of Latin-America looking to the improvement of roads. The exchange rate in Brazil is temporarily down but it has been pointing upward for some weeks and is now considerably above the low point reached during the latter part of 1921. Brazil already has built many roads, as has been shown in previous bulletins, and with this new federal road aid the possibilities in Brazil appear tremendous.



The FORUM

Standard Valve Stems

Editor, AUTOMOTIVE INDUSTRIES:

1. Referring to the bulletin of the Goodyear Tire & Rubber Co., mentioned in AUTOMOTIVE INDUSTRIES of Feb. 9, 1922, and sent by them to the Tire and Rim Association, regarding a standard valve stem for disk wheels that would enable access to be had to the valve for inflating the same from the front side of the disk wheel, is not the real problem a universal or standard valve stem for all types of wheels accessible from the front of all wheels?

2. As is well known, any disk wheel with the valve stem on the back side of the disk is very impractical. While it may be temporarily so used, unless its position is changed it will kill the disk wheel and prevent its extensive use, and, as pointed out, the continued use of the disk wheel leads to the use of a multiplicity of makeshift devices, all more or less impractical.

3. This is a question of valve stems and not valves, as stated in the bulletin, and these must not be confused. In the bulletin the suggestion is made to "standardize on one type of valve," whereas in reality one type of valve stem is meant; for, as a matter of fact, the valve *per se* is always the same and standard, and the only thing that changes is the length of the valve stem itself, which is naturally modified with all the various sizes and types of wheels used, whether these are of the wood-spoke, demountable-rim type with felloe band, the wire-wheel, or the disk detachable type without felloe band.

4. At present, to meet these various conditions, it requires for the various sizes of tubes six or seven different lengths of valve stems and at least two or three different lengths of valve stems are used in each size of tube, requiring tire makers' dealers to stock two or three different tubes of each wheel size and tube diameter.

5. Added to the above is now the further suggested complication of a valve stem construction that will give accessibility for inflation from the front of the disk wheel, and which, if met in any of the ways suggested, by adopting any device solely applicable to disk wheels, must lead to many more complications, and, as pointed out in the bulletin, may result in each disk wheel maker adopting a special device to suit his individual construction.

6. The construction of the various makes of disk wheels varies to such an extent that any form of valve accessibility that touches the disk itself is impossible unless all disk wheels are of one design, and any suggested standard valve stem must be based upon a predetermined shape and position of the disk relative to the center line of the wheel, and this is impossible without complete and detail standardization of the disk wheel itself.

7. The only completely standardized element of wheel construction, whether the wheel is of the wood-spoke, demountable-rim, wire-wheel, detachable, or disk-wheel detachable type, is the standard rim, and it is necessary to standardize the valve stem relative to the rim only and define and standardize its length and position relative to the standard rim only.

8. In this case the valve stem will be accessible for inflation from the front face of the rim, in a thoroughly

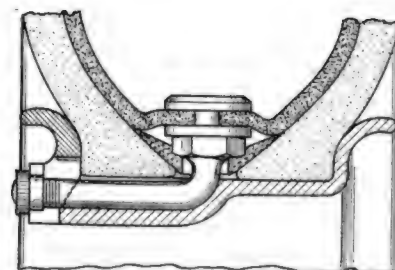
protected position, and identically located for all types of wheels, and without the necessity of delving in between wood or wire spokes or behind the disk of the disk wheel. (See accompanying cut.)

9. An absolutely standard valve stem for each size of rim or tire or tube would give the following results:

(a) A single standard valve stem for each size of rim or tire or tube and every 3½-in. tube and valve stem would always be the same, and only one type of 30 x 3½-in. tube would be made by the tire maker and carried in stock by the dealer instead of two or three as at present.

(b) As the valve stem is accessible from the front of the rim, the ease of accessibility is independent of the number of spokes and the depth of the rim, and the 40 x 8-in. valve stem is quite as accessible as 30 x 3½-in. stem, and both are much more easily accessible than the present valve.

(c) The tire with tube and valve stem complete would be much more easily mounted on the rim, as it could be pushed straight upon the rim and not angled over the rim, and is the only form of valve stem that is practical for the larger sizes of tires, and, in the case of demount-



Sectional view of tire stem, showing location of bent valve stem and accessibility

able rims, would not require a hole through the felloe band, and, in the case of the larger sizes of tires, a cut-away slot in felloe to or beyond the center for the present valve stem to allow the rim to be mounted, causing a great weakening of the felloe band.

(d) This standard valve stem would be 10 to 20 per cent cheaper than the present valve stem and would be much more convenient in every way, especially as the complete tube, in its packed or collapsed state, would require less space and will be more compactly packed into the box and might use a smaller size box.

(e) This standardization would ultimately result in other great savings and economies and be of great value to all users of pneumatic tires, both the automobile makers and the ultimate consumer.

10. The adoption of the proposed standard could be quickly brought about by the tire makers without any increased expense to themselves or the ultimate consumer, and without any complication or expense in any "interim period," during which both types of valve stems might be required, as either system could be arranged to interchange on all existing types of wheels.

11. The advantages and necessity for such a standardization are apparent, and it is up to the tire manufacturers to bring this about, as this would be to their own individual advantage as well as to the advantage of all tire users.



Two views of Beeman tractor showing anti-side draft offset plow hitch

As Sherman said, "The way to resume is to resume," and equally so, "the way to standardize valve stems is to standardize valve stems," and the greatest financial gainers will probably be the pneumatic tire makers.

W. J. P. MOORE.

Eliminating Side Draft with Garden Tractors

Editor AUTOMOTIVE INDUSTRIES:

In his recent article on Garden Tractors, Mr. Ziesen-

heim mentioned particularly the trouble encountered with these narrow tractors with the right bull wheel in the furrow. That, as well as many other things he says, indicates that in some way he has gained some real knowledge with reference to garden tractors, and he certainly will appreciate what we have accomplished in developing one anti-side draft offset plow hitch. We enclose herewith two photographs of one of our tractors operating with this hitch.

E. R. BEEMAN, President,
Beeman Tractor Company.

An Analysis of the Coal Situation

AN analysis, the purpose of which is to give business men information regarding possible fuel supplies in the event of a strike of miners on April 1, was issued recently by the Coal Bureau of the Natural Resources Department of the Chamber of Commerce of the United States. The bulletin carries charts covering conditions in particular localities throughout the United States.

A general summary covering the situations with which the booklet is concluded, says:

"Factors which will control supplies in case of a strike that closes the mines in union fields will be stocks on hand and output of non-union fields.

"Anthracite: As the anthracite field is 100 per cent unionized, all supplies in the event of a complete closing of the mines will have to be drawn from stocks on hand. The United States Geological Survey has published figures based on statements from 648 typical retail dealers, showing the day's supply of anthracite usually carried by them on April 1, as follows:

April 1, 1919	31 days
March 1, 1920	21 days
April 1, 1921	36 days

"If these figures should hold good for all dealers, there would be in dealers' hands, normally, on April 1 about a month's supply. The Geological Survey also give the following figures covering approximate stocks of anthracite, domestic sizes, in hands of producers Jan. 1, 1922:

	Tons
At Eastern points	2,000,000
Storage at Great Lake ports	1,000,000
By-product coke for domestic use....	1,000,000
Total	4,000,000

"Assuming an equal supply on hand April 1, and assuming further, that this supply could be evenly distributed among all consumers, it would last several months, as it would be available at the beginning of the warm summer months when consumption is lightest.

"The probable disarrangement of the usual system of distribution which would result from a strike, the variation in storage capacities and stocks in storage, with the uncertainties of weather conditions make it impracticable to estimate the length of time the supplies of anthracite on hand would last.

"Bituminous: The following statement of the U. S. Geological Survey will be of interest as indicating the days' supplies of bituminous coal in the hands of various classes of consumers in the United States on Jan. 1, 1922:

	Days
By-product coke plants	42
Steel plants	48
Other industrials	51
Artificial gas plants	89
Electric utilities	51
Coal dealers—bituminous	33
Railroads (estimated from incomplete data).....	35

"Subsequent statements are that supplies have increased to some extent up to Feb. 11.

"Average figures covering the entire producing and consuming areas rest on a theory of even division of product and uniform storage capacity and uniform stocks on hand throughout the country. In reality, however, such uniform conditions do not exist in the different communities. Moreover, in case of strike the ordinary lines of distribution are so disarranged that there results great variation in the ability of different communities to secure needed supplies."

Labor Problem Far from Solution

An attempt to weaken the trade unions shows an ignorance of the fundamental causes of labor trouble which previous strikes have not settled. Harmony between the employer and employee depends on the character of the organization regardless of any outside disturbances and influences.

By Harry Tipper

THE trouble with the pressmen in New York, the imminence of the strike of miners, the present strike in the textile field in New England, and reports of other strikes of more or less importance to their industries or localities, indicate how little the problem of labor has been solved by the previous strikes and how far the manufacturers are from being in a position to control the actions of the workers with any degree of efficiency in these various lines of endeavor. There is a good deal of interest in the fact that in all these strikes certain shops have been unaffected. In the pressmen's strike in New York, one of the newspapers was entirely unaffected and is not involved in the trouble as the aftermath of the strike. In the coal strike, some of the mines are not affected; in the textile strike in New England some of the mills are not affected.

These circumstances prove with renewed evidence that the individual establishment is capable of maintaining an agreement with its own employees regardless of the surrounding disagreements, if the proper organization has been built up. The amount of time lost and the money involved in the cost of these strikes is very large, but the loss of efficiency due to the difficulties created by the strikes, the bitterness resulting from the fight and the general antagonism is likely to be greater than the cost of the actual interruption of work. The difficulties of the individual establishments in avoiding strikes are not to be charged merely to the fact that they are in some cases non-union, and in many cases do not pay any attention to the union considerations. If they were notably unfair or unjust to their workers it would be a comparatively simple matter for these workers to organize themselves in order to enforce their demands. In fact, this has been done in scores of cases where there was a real grievance. In these individual establishments there is an opportunity to get together with the employees because the discussion relates to the same immediate organization and the same problems, without the interference of outside groups composed of manufacturers or workers, and officered by men who have added to the desires of members of the group their own demands and their own necessities for action. It is useless to consider the merits or demerits of these strikes. The coal miners claim that the wages have not affected the price of coal, as charged by the operators; that the operations of the mines are

notably inefficient as they average only 3 to 4 days per week at work, and that the present wage is not any more than they are entitled to. The actual strike, however, has been caused by the maintenance of a stubborn attitude by both sides to the controversy, which attitude indicates that they are willing to have the matter go to a trial of strength and are not particularly anxious for an agreement. The operators have admitted through their spokesmen that their present intention is to beat the union, a victory which will be of no value either to the coal industry or the rest of the people because it will form merely a basis for future disagreement. They are evi-

dently disinclined to compromise or to arrive at any agreement, hoping to break down the strength of the union at a time when the production of the coal product is not required to such a large extent, and when the surplus supplies are plentiful.

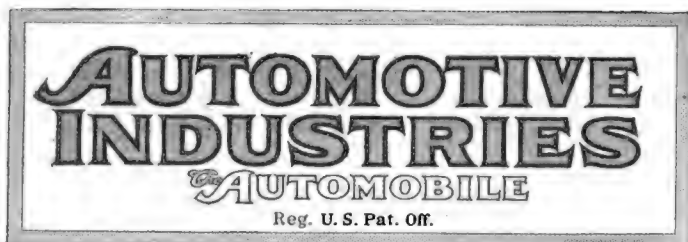
It would seem that the coal operators have not been particularly anxious to avert this strike and, in fact, the actions they have taken would indicate that they have themselves in a sufficiently strong position to be willing to let the matter go to a strike in order to break the strike and thereby weaken the union. It is astonishing that employers groups should learn so little from past experiences.

The history of labor union development is one long record of strikes, many of which have been broken, sometimes after months of idleness. In spite of all these defeats the trade unions have grown stronger and have succeeded in securing more from the manufacturer. It is not likely that the success of the coal operators in the strike will weaken the union, and before long that fact will be evidenced in some way or another. The only way in which the unions can be weakened is by the adoption of methods that will provide a greater degree of fair play and justice to the worker than those which the union adopts.

The absence of any serious consideration of the labor question at this time is indicative of the fact that the manufacturer associates labor troubles only with the acute difficulties of strikes and interruptions. Labor is not any more satisfied than it was in 1920, and the labor unions have not receded from their position in any single point. The problem of developing a satisfied and contented organization within the factory is still up to the individual manufacturer.

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Stresses Due to the Transmission Brake

ONE of the objections often urged against the transmission brake is that it imposes greater stresses upon the propeller shaft, differentials and rear axle shafts than would otherwise occur. The reasoning behind this argument, however, is not always as clear and convincing as might be desired.

If the transmission brake is well designed it is usually an easy matter to stall the driving wheels with it, and the stress on the propeller shaft, rear axle shafts and other members of the transmission line then depends directly upon the adherence of the rubber tires to the ground. The more powerful cars and trucks are so designed that when the engine develops full power on the low gear, and especially on the reverse, there is enough torque on the drive wheels to slip them on ordinary dry road surfaces. In laying down the specifications for the Class B military truck, for instance, this was one of the points insisted upon. But there is one condition of operation under which the torque on the transmission members can be ma-

terially increased over that which the engine can produce on a steady pull. If the truck or other vehicle gets stalled on a heavy road it is a very common thing for the driver to put his gear in low, speed up the engine and let the clutch in quickly. Under such conditions, owing to the energy stored by the flywheel and the excess capacity of the clutch beyond the maximum steady torque of the engine, much greater torque can be impressed upon the drive members than in steady driving. The only thing that limits the torque transmitted under such conditions is the adherence of the drivers to the ground, and the limit on the driving torque is therefore exactly the same as the limit on the braking torque. It is true that this driving torque is abnormal, yet it is likely to occur on any truck and must be provided for in the design.

It is therefore not correct to say that the transmission brake imposes heavier stresses on the driving members than any due to the drive itself. On the other hand, the fatigue effects of the braking stresses are additional to the fatigue effects of driving stresses, and since the wheels will undoubtedly be locked by the transmission brake much oftener than they will be slipped on solid, non-slippery surface by a sudden release of the clutch, it is not unlikely that fatigue strains cause an earlier failure of the drive members if a transmission brake is used.

Percentages

THIS editorial is intended not for mathematical sharps but rather for those whose mathematical education has been neglected, if any such there be among the readers of AUTOMOTIVE INDUSTRIES. We fully believe that the great majority of our readers are thoroughly sound in their use of percentages, but, of course, the minority always has a right to consideration.

We often hear the statement that between the extreme values of a variable there may be a difference as great as — per cent. Now, a difference cannot be properly expressed as a percentage, because one can never tell whether the percentage is based on the smaller or the larger of the values. For instance, between 40 and 120 there is a difference of 80, which is 200 per cent of the smaller and $66\frac{2}{3}$ per cent of the larger figure. The statement might be rendered precise by saying that the difference between the extreme values may be as great as — per cent of the lower value, but it is much better to express this relation by saying that the quantity may vary between limits of the ratio of 1 to 3 (using the values of the foregoing example).

Right here it may be in order to point out that a quantity cannot be reduced by more than 100 per cent. This would seem to be obvious, yet statements in which something or other is decreased by more than 100 per cent are met with constantly—naturally less frequently in printed than in hand-written or typewritten matter, because most of the material that appears in print has been gone over by one or more editors and by one or more proofreaders after the author has finished with it. This slip sometimes occurs in unexpected places. For instance, some years ago a rather successful business man with a

college training, who was then president of a leading engineering society, in a public address made the rather surprising statement that by the introduction of improved machinery the production cost of some automobile parts had been reduced 300 and even 400 per cent.

To make percentage figures definite and comparable they must always be based on the same thing. For instance, commercial profits should always be based upon the sales price. If a dealer buys an article at 80 cents and sells it at a dollar, the profit is 20 per cent, not 25.

Some people make a habit of using the percentage method of comparing magnitudes where it is not particularly suitable. For instance, the statement may be made that, in 1920, 10,000 per cent as many automobiles were manufactured as in 1902, which is the same thing as saying that the 1920 production was 100 times as great as that of 1902. The writers who affect this style undoubtedly belong to the impressionist class and are looking for the largest possible figures to use. A small value can be conveniently expressed as a percentage of a larger one, but to express a very large value as a percentage of a small one is not advisable.

The Genesis of Service

MUCH water has gone under the automotive bridge since 1904. Volume of business has increased, design and performance have been improved immeasurably, methods of selling and service have been considerably refined. But many fundamentals are found to be the same in 1922 as in 1904.

Many of the veterans of the industry will find considerable interest in the following editorial which appeared in *Horseless Age* of Nov. 9, 1904. We ran across it the other day and it brought so much food for thought to us that we are passing it along. The editorial was headed, "The Importance of the Agent," and it read like this:

Until about four years ago, the early, successful manufacturers of automobiles declined all offers of would-be agents, as they had no difficulty in selling all the machines they could make, and did not care to pay an agent's commission. In 1901, however, the number of practical machines and the capacities of the individual manufacturers having greatly increased, most of the leading firms found it advisable to establish branches or agencies in all the large cities, and from that time on the agency has continued to grow in importance as a factor in the automobile business. At present many more cars are sold through agents than by manufacturers direct, and the product of a few large concerns is disposed of almost entirely by agents.

In any city where a considerable number of cars are represented, a manufacturer not represented and located at a distance will find it practically impossible to make a sale. The present day purchaser wants to be convinced of the merits of a car by demonstration rides, etc., and will not, as a rule, make a lengthy trip to a factory if he can inspect and test many dif-

ferent makes right in his own city. Then, too, there are many real advantages to the new owner in the fact that an agent for his car is conveniently located in his home town. He will receive more careful instruction in the operation of his machine, and in case of any difficulty during his early experience it will be a great aid to have the agent near to advise and assist.

Agents usually carry a considerable stock of repair parts, and a break or wearout necessitating the renewal of a part causes less delay if the part can be supplied by the agent from stock than if it had to be shipped from the factory.

Finally, in the smaller cities, if a car is bought from a dealer, well and favorably known, it is an assurance to the purchaser that he will be treated fairly in every respect, and that the manufacturer's guarantee will be lived up to. In view of these several facts, the automobile purchasing public prefer to deal with agents, and manufacturers are therefore obliged to appoint agents for all territory in which they expect to do a considerable business.

Since the local markets are thus controlled by agents, and the local business is divided among them largely in proportion to their respective business ability, reputation for integrity, etc., manufacturers are deeply concerned in securing the most capable agents in every locality. As the movement progresses, the difference in the actual value given for the money by different manufacturers will be shaved down finer and finer, and the different models will more closely approach each other in general design. This renders the choice between the different makes of cars constantly more difficult for the purchaser, and sales depend more upon the agents' ability than in the past. The capable agent is, therefore, in great demand at present, and this season, practically for the first time in the history of the industry, his services are being competed for by the leading manufacturers.

Manufacturer's Agents

WE are witnessing the entrance into the field of a new method of automobile distribution, a method which is well known in some automotive products and in other lines, but which has never been used extensively in the selling of motor cars and trucks. It is the use of a manufacturer's agent or jobber. The nearest approach to this has been the controlling of sales of the manufacturer's output by a separate company acting in conjunction, and with an interlocking of interests, with the manufacturer.

Because of the increasing necessity of studying problems relative to the marketing of motor cars and trucks, it may be well to consider the advantages and disadvantages of this method of distribution. Whether the saving accrued will outweigh the loss of personal contact between the manufacturer and the retailer remains to be seen. Many of the minor details of this form of marketing may be advantageous and applicable to the manufacturer marketing his product through his own selling organization. The method is worth analyzing.

Knudsen Takes Charge of Chevrolet

Ex-Ford Production Expert Joins G.M.C.

Election Indicates duPont Has Taken Actual Control of Corporation's Policies

DETROIT, March 27.—The election of W. S. Knudsen as vice-president in charge of operations of the Chevrolet Motor Co. and the assignment of K. W. Zimmerschied, although continuing as president, to advisory duties connected with the office of Pierre S. duPont, president of the General Motors Corp., may be defined in a measure as ushering in duPont as the real active head of the great motors combination.

duPont Has Studied Industry

Since duPont became president of General Motors after the retirement of W. C. Durant, he has confined himself more to a study of the industry, the company's units and possibilities of development than to the active direction of its forces. Practically a stranger to automotive manufacture, he has, for more than a year, been acquainting himself with the men in the industry and the factors that have brought it to its present strength. The realignment of Chevrolet is credited directly to duPont.

Knudsen, former production manager at the Ford Motor Co., was brought into General Motors two weeks ago as assistant to Vice-President C. S. Mott, chairman of the advisory staff of the company. In those two weeks he made a survey of several General Motors units, including the Tarrytown plant of Chevrolet and made certain recommendations. His appointment as operations head of Chevrolet came after these recommendations.

Bigger Production Likely

It has been no secret that Chevrolet has been unable to get into production on a scale that, coupled with present prices, would make the unit a profit producer. With Knudsen's experience in Ford manufacture, and it is said he is one of the few Ford men who ever resigned from that company, General Motors plans to gain the utmost efficiency in the production of its low priced car.

Since the duPont regime in General Motors began, the Chevrolet small car has been steadily built up mechanically to give the utmost value at the price. It is now a question of making the car, with its improved units, at a production

Business in Brief

NEW YORK, March 28.—The Federal Reserve Bank of Atlanta has reduced the rediscount rate from 5 per cent to 4½ per cent because of materially improved conditions.

Crop conditions in the Middle West are decidedly better than a few weeks ago, and strengthening of rural purchasing power has begun to translate itself into orders.

Grain and livestock trade sentiment remains bullish. Ranchmen are planning to replenish their herds.

Freight traffic continues to expand, and there has been a further reduction in the number of idle freight cars.

Steel mill operations, which in some cases are at 65 per cent of capacity, reflect almost unprecedented building operations, which also have served to strengthen the lumber market.

Steel mill and furnace operations generally are expanding.

A feature of the cotton market is its continued strength in the face of bearish operations.

The hide market continues dull, although there has been an increase in footwear production.

Retail distribution of dry goods shows a seasonable quickening.

Bank clearings for the leading cities for the week ending March 23 were \$6,817,817,000, a gain of 2.7 per cent over the previous week.

The trend of interest rates is steadily lower.

Investment demand for attractive securities, both new and old, continues strong.

rate that will justify prices. The company will concentrate all its efforts on the manufacture of the small line, the F. B.

K. T. Keller will remain as a vice-president of Chevrolet and manager of manufacturing, according to the duPont announcement, and Colin Campbell will continue as vice-president of the several sales companies and general sales manager of Chevrolet.

In connection with the changes, it is recalled at General Motors headquarters that Zimmerschied will be resuming work of a nature similar to that performed by him under Durant. The resignation of Durant from General Motors and Chevrolet resulted in Zimmerschied being elevated to the presidency of Chevrolet.

April Will Surpass March in Business

This Month Has Improved Over February, Which Showed Parts Trade Doubled

By James Dalton

NEW YORK, March 28.—March will show a decided improvement over February in the manufacture and sale of motor vehicles. Orders already booked by makers of parts and materials assure a better business for April than for this month. Beyond April the outlook is uncertain but there probably are few industries which can look as far ahead as May 1 with assurance of satisfactory sales.

A few parts plants are running at capacity and a substantial number of them are producing at 50 per cent of capacity or more. The total of sales by parts makers in February was approximately double that of January and aggregated the business done in March, 1921, which marked the renaissance of the industry after the slump.

Partly Due to Deflated Inventories

The better business which is being enjoyed by parts manufacturers is due in part to the deflated inventories of motor vehicle builders but not all of it, by any means, can be attributed to this cause. It demonstrates conclusively that both passenger cars and trucks are being sold in much greater volume than at the same time last year. Neither branch of the industry is building up a reserve of completed vehicles and all makers are holding their schedules approximately to actual retail sales.

Spring sales at retail, in substantial volume, have begun nearly two months earlier than they did last year. Speaking comparatively there may be a falling off after May, but a production total of passenger cars equal to 1921 is practically certain and the total of trucks will be substantially larger.

The tone in Detroit is immeasurably better than it was at this time last year and confidence has replaced uncertainty. This confidence is solidly founded and few manufacturers have extravagant hopes. They are studying their markets with the greatest care and making dealer allotments on this

(Continued on page 742)

Action Postponed Against National

No Hearing on Petition for Receivership Pending Move Toward Settlement

INDIANAPOLIS, March 27—Hearing on an application for the appointment of a receiver for the National Motor Car & Vehicle Corp., filed by the Columbia Axle Co. of Cleveland, has been postponed until April 1 at the request of attorneys representing the creditors' committee. The postponement was with the consent of lawyers for the axle company and was based on information that a settlement of the suit might be reached out of court.

Lack of Working Capital Claimed

The petition of the plaintiff alleged that the liabilities of the automobile company were in excess of \$1,300,000 and that the company's business was suffering from a lack of working capital. The petitioners represent a claim of \$12,305.

Company officials and officers of the Fletcher American National Bank, the vice-president of which, Oscar Welbon, is chairman of the creditors' committee which is operating the National factory, insisted at once that the suit had been brought through error. They also said that a representative of the Columbia Axle Co. had been in the city the day before the suit was filed and received a settlement that was satisfactory, and added that the suit would be dropped shortly. Elmer Stout, vice-president of the Fletcher American National Bank, who has been acting as an advisor of the creditors' committee, also affirmed that the suit would be dropped immediately.

Say Suit Was Misunderstanding

To-day George M. Dixon, president of the National company, and M. E. Elstun, secretary-treasurer, gave out the following statement: "The court action was brought through a misunderstanding and will be entirely eliminated by the plan now completed and to be carried out fully at once.

"The financial affairs of the National Motor Car & Vehicle Corp., according to the present agreement with all parties concerned, will be carried out as originally planned."

When the announcement of the refinancing of the concern was made some weeks ago, and the placing of a \$750,000 mortgage on the plant was made known, it was stated that but part of the bonds that were to be issued would be floated at that time, and that additional working capital would be supplied in the future.

ERIE OFFICIALS INDICTED

ERIE, PA., March 27—The Federal Grand Jury has returned indictments against officials of the Erie Tire & Rubber Co. charging them with using the mails to defraud and conspiracy.

The Farmer Will Play a More Important Part in Progress of Industry This Year

By Walter P. Chrysler

Chairman of the Board of the Maxwell Motor Corp.

Detroit, March 23.

FARM buying will have an important part in the progress of the automobile industry in June, July, August and September. There has been considerable buying recently by the farmers, due to an increase in prices for some of their products, notably corn and hogs, and this business will grow as the demand for other of their products brings better prices.

Buying by the farmers after September will lessen, but it will greatly exceed their buying in the winter months of this year and last, when it was practically stopped.

Payment of a soldier bonus should not depress business inordinately if handled by the government on a sound basis. There should be no increase in taxes required. Those soldiers who were injured or are in need should be taken care of at once at all costs. Those who are not in need should be compensated as the business conditions of the country permit.

The more money there is for industry the more work there will be for everyone, and, consequently, more prosperity. Business has made steady gains in spite of resistance, owing to the withdrawal of money from circulation by the government to pay off debts incurred during the war. Prosperity is largely a matter of keeping money in circulation.

It is charged the concern had offices here and sold stock on the false claims that it had acquired a 60-acre factory site in this city and had started building a five-story plant. The company was incorporated in Delaware for \$10,000,000, divided into 200,000 shares. The Government claims the company purchased no property and had not started a building. The company claimed it had a patent on a double-durability tire.

The officers indicted are: E. H. Blackstone, Robert T. Philip, Albert L. Sleeman, E. W. Snyder, Fred A. Deiberling, Emil Levy, Benjamin Leven and George M. Graham.

Sale of Obenberger Approved by Court

MILWAUKEE, March 27 — The sale of the assets of the defunct John Obenberger Forge Co., appraised at \$955,342, for the equivalent of \$233,000, to Adolph Weidner, Milwaukee attorney representing the secured creditors, has been approved by the bankruptcy court. The bid was made under the first call on March 10, but was held open by the referee with instructions to J. F. Gerdis, trustee, to seek other bids. Since none were forthcoming, the single original bid was ordered accepted.

The bid of Weidner involves only \$48,000 in cash, but the purchasers agree to assume all secured claims, amounting to \$185,000. The cash will be used as dividends to unsecured creditors, who will receive about 2 per cent, according to Gerdis. Unsecured claims total \$500,880. Administrative expenses will come out of the \$48,000, however.

The larger secured creditors in whose behalf the bid was made are the First Wisconsin National Bank of Milwaukee; Klug & Smith, Milwaukee contractors, and the Erie Foundry Co., Erie Pa. According to Weidner, the new owners expect to resume operations in about 30 days.

Form Steel Company with Wills Director

Capitalized at \$15,000,000—Will
Manufacture for Automobile
and Allied Producers

DETROIT, March 27—C. Harold Wills, president of C. H. Wills & Co., is named as one of the board of directors of the new Dominion Alloy Steel Corp., Ltd., which will undertake the production of alloy steel in Canada with a plant at Sarnia, Ont., opposite Port Huron, Mich. The company will have an authorized capitalization of \$15,000,000.

Plans thus far made public call for the production of 50,000 tons annually of alloy and high-carboned steels for automobile and allied manufacturers. The work will be financed by the sale of \$3,500,000 8 per cent cumulative preferred stock, of which \$2,500,000 is said to have been underwritten in Detroit and Cleveland, and \$1,000,000 in Canada.

George A. Simpson, formerly sales manager of the Steel Co. of Canada, it is declared, will be vice-president and general manager. Other directors so far named are Harry R. Jones, Canton, president of the United Alloy Steel Corp.; J. J. Mahon, Newark; Sir William MacKenzie, Toronto; Bert H. McCreath, Toronto; Col. William McBain, Toronto; W. Wallace Johns, Toronto, and W. B. Boyd, Toronto.

BUS PLAN FATE IN DOUBT

NEW YORK, March 27.—Trial of a suit instituted by Edward Schafer, a taxpayer, to restrain the Board of Estimate of this city from appropriating \$1,000,000 for buses, is expected to begin here to-morrow. If the city wins, it will have the right to spend as much money as it sees necessary, even to the extent of \$30,000,000, which its bus plans call for.

Walker Refinanced; Banks to Aid Others

Cleveland Companies Needing It Will Be Provided With Ad- ditional Capital

CLEVELAND, March 26—The refinancing of the H. J. Walker Co., maker of automobile engines, which has been announced here, is one of a number of contemplated steps to be taken by banking and financing interests of this city to provide additional capital for half a dozen Cleveland companies that are making automobile parts and accessories, according to well defined rumors.

With inventories worked down and other adjustments made, some of the companies find that the financial surgical operation was rather rough and that it left them lank and lean.

Banks in Better Position

The banks and financing interests here are said to be in a much better position than they were six months or a year ago, and they are now in a position to come to the relief of corporate interests that are intelligently managed and have a worthy product.

The plan for the refinancing of the Walker company, which supplies engines to the Grant Motor Car Corp. and others, was disclosed in letters that were mailed to stockholders.

It is known that a strong group has been formed for the refinancing and that when the names are announced they will give weight and prestige to the company. Until the plans are approved by the stockholders, the names of the syndicate managers and the new operating management will not be disclosed.

The Grant company will be greatly strengthened financially by the operation of the plan proposed, and it will help the corporation to push production and extend its sales campaign.

The notices that were sent to the stockholders propose that the \$600,000 bond issue that is due in 1925 and which carries 8 per cent interest, should be exchanged for 10 year 7 per cent bonds that will fall due in 1932. This exchange would save the company 1 per cent in interest, and in the 10 years would amount to approximately \$60,000.

\$350,000 Floating Indebtedness

There is a floating indebtedness of \$350,000, and this will be taken care of by a new issue of \$350,000 of 7 per cent cumulative preferred from Jan. 1, 1923. This issue is to be taken at par by the creditors for their claims.

When the creditors do this, a syndicate of bankers and financiers that includes some of the best known men in this city will step in and provide the company working capital by purchasing common stock to the extent of \$300,000.

Under such a plan as this, the company will have no obligation of a pressing nature, and its obligations will be

limited to the funded debt, and with the capital provided it is felt it will have ample opportunity to develop its business.

It is stated that 50 per cent of creditors already have approved the plan, and that among this number are some of the larger ones. This makes operation of the plan probable.

Application to Appoint Templar Receiver Denied

COLUMBUS, March 27—Upon the grounds that the plaintiff, Nathan T. Clyburn, had not made a sufficient showing to the court to warrant such action, Judge Warner, in Common Pleas Court, refused to appoint a receiver for the Templar Motor Car Co. of Cleveland.

The court based its decision upon two grounds: first, that a creditors' committee is now in charge of the company and is performing the same service as a receiver, and second, that a syndicate committee has offered a plan of reorganization which has been adopted by the stockholders and that from this plan of operation a refinancing of the company seems evident.

Judge Warner also held that the company was not insolvent, as it had \$1,387,000 assets as against liabilities of \$1,131,000.

Court of Appeals Affirms Decision Against Livezey

NEW ORLEANS, March 27—William S. Livezey must serve a five-year sentence in Leavenworth Federal penitentiary for use of the mails to defraud in connection with raising the \$3,000,000 capitalization of the Little Motor Car Co. of Dallas of which he was president. The United States Circuit Court of Appeals here has affirmed the decision of the Federal Court at Dallas which convicted him.

Livezey was arrested April 13, 1920, after a receiver for the company had been appointed at Dallas on petition of stockholders who alleged that the company's affairs were being mismanaged. He was convicted in February, 1921.

United Auto Stores' Sale Postponed Until April 7

PHILADELPHIA, March 25—Petition of the receivers of the United Auto Stores, Inc., for permission to sell the assets of the company resulted in the sale being held over until April 7 by Federal Judge Thompson.

Stockholders are given opportunity by this postponement to formulate a plan for reorganization, in the meantime. According to Samuel A. Whitaker and Francis F. Burch, the receivers, sale of the company's assets is imperative in order to put a stop to the payment of rentals on the 58 stores in the company's chain, none of which is earning money at this time.

Executives Further Plans for Zeder Car

Confer on Promotion of Com- pany—Experimental Work on Product Not Completed

NEW YORK, March 27—Negotiations for the promotion of a company which will build, at the plant of the Cleveland Tractor Co., a new six-cylinder automobile selling at about \$2,000 and to be designed by F. M. Zeder, approached completion at a series of conferences held here within the past few days. A complete announcement of the plans which have been worked out is expected in the near future.

Among those prominent in the conferences here were Clement Studebaker, Jr., Rollin H. White, president of the Cleveland Tractor Co.; R. T. Hodgkins, vice-president of the same company; Earl B. Wilson and Zeder, with several other engineers who have been associated with him for years. The identity of capitalists other than Studebaker and White who will have a share in the enterprise has not been disclosed.

After the preliminary negotiations have been completed it will be necessary to submit the entire proposal to the stockholders of the Cleveland Tractor Co., although this is expected to be largely a formality in view of the fact that acceptance of the plan will be recommended by the officers and directors. It has not been determined in just what way the present stockholders will be connected with the new enterprise.

Separate Plant for Car

It is probable the new car will be built by an entirely separate company in the Cletrac plant.

Experimental work on the Zeder car will not be completed for at least nine months. Designing work will be done at the Newark offices of the Zeder-Skelton-Breer Engineering Corp., but the experimental models will be built in the Cletrac factory.

Associated with Zeder in the development of the new car will be O. R. Skelton and Carl Breer, who went with him from the Studebaker Corp. when he was engaged by the Willys Corp. to design the Chrysler Six. When they severed their connections with the Willys Corp. they formed the engineering corporation to keep their organization intact. It is asserted positively by Zeder that the car which will bear his name will not in any sense be a copy of any developed heretofore, but will be an entirely new product worked out along scientific lines as the result of his own experience and that of his associates.

TRACTORS AND LITHUANIA

LONDON, March 14 (by mail)—The Lithuanian Minister of Agriculture considers that the wider introduction of tractors will result in the doubling of Lithuania's crop production.

40-Hour Week, New Ford Plant Policy

Because of It Company Will Give Employment to 3,000 More Men

DETROIT, March 27—A forty-hour week of five days, with a shutdown Saturday and Sunday, hereafter will be the permanent working policy of the Ford Motor Co. and all other Ford interests. All employees will continue to receive the \$6 a day minimum wage. Approximately 50,000 men will be affected and additional workers will be necessary under the new policy.

As soon as the new schedule can be put into effect at the Highland Park plant it will be extended to the other factories. In making the announcement, Edsel Ford said:

Every man needs more than one day a week for rest and recreation. The Ford company always has sought to promote ideal home life for its employees. We believe that in order to live properly every man should have more time to spend with his family.

Right now market demands warrant the operation of the plant six days weekly, but we are satisfied that the five-day week is practical and it has been adopted as a permanent policy of the company. Adjustments, naturally, are necessary. In equipment and in man power the plants will have to be placed on a basis where they can take care of production in five days weekly. It will mean work for 3,000 more men. It will mean more machinery. The goal cannot be fully realized at once. But as soon as possible it is the aim of the Ford company to adjust its business so that it can be carried on without work on Saturday and Sunday.

Demand for Trucks Increased

While Ford passenger car production now is considerably ahead of production at the same time last year, I believe the increased demand for trucks is a better indication of improvement in business conditions.

The demand for trucks has become more insistent each week. The truck is a business vehicle and increased demands must mean better business conditions.

Production at the plant of the Lincoln Motors Co. is now averaging from twenty to twenty-five a day. The market would warrant an output of sixty cars a day. Gradually the methods employed at other Ford plants are being installed, but it is doubtful if production ever will exceed fifty cars daily. Just this week a new aluminum casting plant for the Lincoln went into commission at River Rouge. Parts for the Lincoln will be cast at River Rouge and machined at the Lincoln factory, as is done with parts for other Ford vehicles.

The Ford company is co-operating with service organizations in seeing that deserv-ing ex-service men receive first consideration in the matter of employment.

Will Include Lincoln Plant

DETROIT, March 27—The Ford five-day week will ultimately include the Lincoln Motors Co., but it will require considerable organizing to meet production demands before it can become effective. At present Lincoln is about 2000 cars behind on orders and will not catch

BATTLESHIP AND FORD WILL OPERATE AS ONE

DETROIT, March 27—"If satisfactory arrangements can be made it may not be long before metal that was once a part of an American battleship will be running around in the form of a Ford car or tractor," says a statement by the Ford Motor Co. "The quality of the metal in war vessels will permit this.

"It can be remelted, carefully tested as to its suitability for mixing with other quantities of molten metal and poured into cylinder blocks and various castings. This ore that was mined, converted into metal and used in ship construction at great expense will not be an entire loss. Some, at least, of the taxpayers' money will be returned to the Treasury and, in addition, useful tractors built."

up, working the full week and extra time in some departments, until well into the summer. A schedule of 700 has been fixed for April.

Privileges of the Ford investment plan now have been extended to Lincoln employees, thereby effecting a new bond between the new and old Ford enterprises. There is now \$10,000,000 invested by 18,000 Ford employees under the investment plan. Interest and special returns of \$1,250,000 have been paid to investors in the two years the plan has been in operation.

The Ford Motor Co. is working on a schedule of 67,000 cars and trucks for March. Foreign plant totals for February show Buenos Aires with 1245 cars and trucks; Manchester about 2000, and the Ford Motor Co. of Canada, 4000 cars and trucks. Bordeaux, Sao Paulo, Cadiz and Copenhagen were reported to have had good months.

Transport Completes New Line of Trucks

MT. PLEASANT, MICH., March 27—The Transport Truck Co. has a new line of trucks ready for distribution to dealers. There is a new Rapid Transport of 1-ton capacity for high speeds and heavier models, which differ from the previous line in capacity and are considerably lower in price. The following table shows the old and new models:

New Models	Old Models
15, 1-ton.....\$1,295	20, 1-ton.....\$1,395
25, 1½-ton..... 1,495	30, 1½-ton..... 1,995
35, 2-ton..... 1,885	50, 2½-ton..... 2,785
55, 3-ton..... 2,385	70, 3½-ton..... 3,885
60, 3½-ton..... 2,585	
75, 5-ton..... 3,485	

The rear axle of the Model 15 is of bevel gear type. On the former line, all models had internal gear axles. The heavier models still retain this form of final drive.

No Ownership Change for American Dunlop

President Dissipates Rumor That Ford Will Buy—Production Prospects Indefinite

BUFFALO, March 27—The Dunlop Tire & Rubber Co.'s plant here will be operated as a Dunlop institution by the company which was formed for that purpose, Frederick Wolcott, president, declared upon the occasion of a visit to this city. Upon his arrival from New York he went into conference immediately with Perry D. Saylor, vice-president of the corporation.

"I am unable to say at this time when production will begin," Wolcott said. "We are working on plans which will lead to production, but it would be foolish for me to fix a date when we will begin producing tires in commercial quantities. The date will depend on a number of circumstances and conditions.

"It is my hope to be able to make a definite announcement within the next three or four months. I am very hopeful that this announcement will be very favorable to Buffalo.

"Sale of the plant to Henry Ford or any other person or corporation is not even being considered," Wolcott added. "Any rumors that the plant is to be sold are entirely without foundation. The factory will be operated as a Dunlop institution by the company which was formed for the purpose."

Puts End to Many Rumors

Wolcott's statement puts an end to many rumors which have been in almost constant circulation for many months. It has been repeatedly rumored that Henry Ford would take over the plant to produce tires for Ford cars. There have been numerous other rumors of sale of the plant, but heretofore there has been no official denial or confirmation of the reports.

The coming of Wolcott to Buffalo was rather unexpected. At 8 o'clock in the morning Saylor was not aware that he proposed coming. Wolcott arrived on an early train and went direct to the plant, where he planned to remain until after a conference had been held with the firm's attorneys.

Wolcott is in charge of all the Dunlop tire interests in the United States. The American branch of the British corporation is partly financed in this country, but is under control of the British Dunlop interests.

Production Never Undertaken

Commercial production of tires has never been undertaken at the River Road plant, although experimental manufacture has been in progress for many months. It is said the company is planning to specialize in a small size cord tire, when production begins, and that this tire will be sold at a price close to the present cost of fabric tires of the same size.

Reorganization Plan of Premier Delayed

In Meantime Suit Is Started by Bank to Collect Skelton's Insurance

INDIANAPOLIS, March 24—Reorganization plans of the Premier Motors Corp. which were scheduled to have been completed at a meeting of the reorganization committee March 21, have been delayed, and the official statement that was promised by a member of the reorganization committee for Wednesday has not yet been made.

On that day at Martinsville, Ind., a suit was brought by the Fletcher American Bank of Indianapolis against the Travelers Insurance Co., the American Life Insurance Co. and the Premier Motors Corp., to collect a policy for \$200,000. The policy was taken out by the late L. Sherman Skelton, former Premier president, and was transferred by him to the motor corporation which in turn transferred it to the Fletcher American Bank. The insurance companies are fighting payment because they assert Skelton withheld certain facts concerning his health at the time he took out the policy.

Same Bank in Charge

It was understood that the bank that was expected to handle the details of the proposed reorganization is the same one that is suing the insurance companies and the Premier corporation. M. A. Whipple, vice-president of Premier, the spokesman for the reorganization committee, stated early this week that the reorganization was practically complete, that mere details were still pending, that 75 per cent of the merchandising creditors had agreed to the plans, that three or four new directors were to be named, and that about \$500,000 of new money would be supplied for working capital.

All these things were to have been finally set by the meeting proposed for last Tuesday, and an official announcement was promised by Wednesday. Since then no further details could be obtained, except with reference to the suit referred to above and intimations that the statement, when made, would be announced by the banking institution handling the deal. The management after the reorganization, according to Whipple, had not been agreed upon by Wednesday afternoon.

Marlin-Rockwell Tax Dispute Is Adjusted

NEW YORK, March 28—The following statement has been issued by the Marlin-Rockwell Corp.:

"The tax dispute of the Marlin-Rockwell Corp. with the Government has been adjusted and the tax paid," according to H. C. Pryer, treasurer. "The corporation officers and directors state that the attitude of the treasury department has been fair and reasonable."

It states further:

The future policy of the corporation will be to confine itself to the ball bearing business which it operates under the Standard Steel & Bearing, Inc., of which it owns all the stock, and the liquidation of those assets which are unnecessary to this industry.

The management states that the bearing manufacturing facilities of this corporation are the largest of any of the companies engaged in this business except the General Motors, and the newest and most modern.

The corporation's present business reflects the general revival in activity in the automotive industry which it serves. Guy W. Vaughan, president and general manager of the Standard Steel & Bearing, Inc., has been elected vice-president of the Marlin-Rockwell Corp.

The Government's original claim is understood to have been in the neighborhood of \$8,000,000.

Special Delivery Car Brought Out By Buick

FLINT, MICH., March 29 — Buick Motor Co. has brought out a special delivery car on a 4-cylinder chassis, with three types of bodies. The open express is priced at \$945; the canopy top delivery with roll curtains, \$965; canopy top delivery with screen sides, \$1,015; panel side delivery with steel panels, \$980 and panel side delivery with vehisote panels, \$1,005.

The bodies are especially designed for strength and rigidity achieved by the extra strong bracing and steel binding of panels, flare boards and tail gate. An additional re-inforcement is assured by heavy steel angles running the entire length of the body along each side to form a side frame. The rear end is entirely sill-bound and scuff strips extend well into the body and bend over to join the reinforcement construction.

The vestibule has steel sash drop windows, which are cushioned to prevent rattling. The doors may be secured back for summer driving. The engine, starter, clutch and other units are identical with the four cylinder passenger car chassis.

Purchaser of Quality Tire to Resume April 1

ANDERSON, IND., March 27—The International Rubber Co. of America, incorporated in Delaware, whose bid of \$200,000 for the Anderson plant of the Quality Tire & Rubber Co. has been accepted, is making preparations to operate the factory here probably by April 1. J. D. Wiggins, president and general manager, formerly was connected with the American Can Co. M. D. Ganger of Cleveland will be vice-president and general manager. They will move here at once. A. L. McKee, secretary and treasurer, also of Cleveland, will come here later.

The sale of a factory at Elyria, Ohio, which also was owned by the Quality company, has been agreed to at Elyria but the deal will not be closed until an Ohio form of transfer is submitted, according to Neal M. McCulough, local banker and trustee for creditors.

Star Will Be Built in All Durant Plants

Expansion of Long Island City and Lansing Factories to Be Undertaken

NEW YORK, March 28—Announcement is made by Durant Motors, Inc., that the new Star car will be built in all its divisional plants. This includes factories at Long Island City, Lansing, Muncie, Oakland, Cal., and Toronto.

The Long Island City and Lansing plants will be expanded to provide a production of 20,000 cars a month by Jan. 1 next, including the Star and the Durant Four. The expansion of the Lansing factory will be undertaken immediately. The same will be true at Long Island City, provided the land required can be obtained at what is considered a reasonable price. The engineers and contractors who built the Lansing factory now are in this city looking into the situation.

Reports that Durant Motors have acquired from the receivers of the Willys Corp. the huge factory at Elizabeth, N. J., which never was occupied, are at least premature. Durant engineers have inspected the property carefully, however, and it is understood they have reported it would meet the needs of the company. It is not likely that Durant will acquire the Elizabeth factory unless it can be obtained at a fraction of its original cost of \$10,000,000.

Production of the Star and the Durant will be completely segregated, although it is desirable from a manufacturing point of view that they be built as near together as possible in view of the fact that materials will come from practically the same sources.

Durant Motors also announces that it has placed with the Continental Motors Corp. of Detroit an order for 250,000 motors for use in the Star. This is one of the largest, if not the largest, single order for motors ever placed.

Quantity Output at Lansing

LANSING, MICH., March 27 — The Durant Motor Car Co. of Michigan now has launched into actual quantity production. Arrangements have been made by M. B. Leahy, the Durant general sales manager, for trainload shipments to Kansas City and Cincinnati.

The train to Kansas City will be made up of thirty-six freight cars, carrying a total of 180 4-cylinder Durant phaetons, to the Hathway Motor Co. The shipment to St. Louis will be made up of twenty-five freight cars and will total 125 phaetons.

MOTOR FUEL FROM WINE

LONDON, March 18 (by mail)—The stagnation in the South African wine industry has led to the establishment of a plant at Paarl for the purpose of converting wine into a gasoline substitute. Last year 10,000,000 gallons of unsaleable wine were produced in the Union.

Truck Tire Business Gaining, Akron Says

Is Taken, in Conjunction with Survey, as Indication of General Improvement

AKRON, March 27—That a widespread general increase in the prosperity conditions of the United States is apparent with strong indications of a continued upward trend in all lines of business, is the opinion of Akron tire manufacturers, based upon surveys being made in all sections of the country in connection with district conferences with sales representatives and branch managers.

"Skepticism is abating. Business is picking up encouragingly. We face a big period of prosperity and production along all lines will have to be increased," states W. A. Johnson, tire sales manager of the B. F. Goodrich Co.

Optimism Soundly Based

"The kind of prosperity that is founded neither on guess nor upon the unjustified hopes of optimists, is returning to the country at a steadily increasing rate," says L. G. Fairbank, general sales manager of the Firestone Tire & Rubber Co.

Johnson also says regarding the situation:

One of the best proofs of a return of conditions more nearly normal is the fact that bankers everywhere are advancing money. Tire dealers are paying their bills and are stocking up in anticipation of a heavy trade this spring and summer. Tires are moving much more rapidly than for months. There were over 220,000 passenger cars and trucks built the first two months of this year. This was an increase of 200 per cent over the same output for the corresponding months of 1921, and meant 880,000 tires as original equipment, and another 220,000 truck and motor car tires to go along with such new vehicles as spare equipment.

The downgrade movement has stopped. Automobile sales are speeding up and this increase has its direct reflection in Akron.

Manufacturers here say the truck tire sales constitute a good barometer of general business conditions. They report truck tire sales increasing heavily and accept this as proof that commercial houses employing trucks are again using them extensively and that such renewed truck use in turn reflects a healthier condition in business.

Price Changes Considered

There is still talk of approaching tire price increases. Some dealers, expecting future requirements, are stocking up now so as to be in position to take advantage of the increases in prices when they come. Manufacturers agree that from the standpoint of making money for their stockholders, prices should be increased. It is also admitted that the price slashing war carried on vigorously by competitive tire companies last year, was carried a trifle too far and that the last of the series of price cuts made, which was enforced last December, was excessive.

Move on Upgrade

NEW YORK, March 27—Sales by Mack Trucks, Inc., are running well ahead of last year at this time. If business continues at the current rate, substantial profits are expected for the second and third quarters.

NEW YORK, March 27—H. Alpern, export manager of the King Motor Car Co., reports that foreign sales for February were the largest for any month in the last five years. Agencies have been established in five additional countries. Twenty cars recently were shipped to the dealer in Switzerland.

KENOSHA, WIS., March 27—The Nash Motors Co. reports that shipments for March will exceed the same month last year by approximately 67 per cent. Factory records show that 2081 Nash cars were ordered by dealers and distributors in March last year, while this year's orders for March shipment totaled 3486. These figures include both four and six-cylinder models.

AKRON, OHIO, March 27—The General Tire & Rubber Co. reports that sales for the first quarter of this year have been 65 per cent larger in dollars than for the same period in 1921. In units the sales increase has been 100 per cent. All tires manufactured are sold through dealers to users.

DETROIT, March 23—Chevrolet Motor Co. has started a night shift at the Flint plant for the first time in several months. Nine hundred axles a day are now being made for shipments to the various assembly plants. It is planned to build 800 engines a day by April 1. All engines and axles for Chevrolet cars are now being made at Flint.

DETROIT, March 27—The Fisher Body Corp. reports that it has been compelled to refuse several new orders because of a shortage of manufacturing facilities. Some of the Detroit plants are working overtime while others are not yet at capacity. The average for the Fisher factory is about 95 per cent of capacity.

L. G. Fairbank of the Firestone company does not predict a business boom nor a return of the superficial prosperity of 1920, but says he believes the United States is on the eve of a broad, substantial increase in business that will mean much to every one by reason of the fact that it is founded upon hard work and the creation of new economic values, and not on fictitious and speculative gains in the value of stocks, etc.

Renewal of Demand Felt in Truck Lines

Call Reported to Be for Lighter Types, Principally for $\frac{3}{4}$ -Ton Capacity

MILWAUKEE, March 27—Encouragement is found daily in reports from manufacturers of passenger cars and the parts industry as well, which indicate that the improvement which set in 30 to 40 days ago is going forward. A little better feeling also has been injected into the motor truck industry by something akin to a renewal of demand, although this is yet far from satisfactory. So far the principal call has been for the lighter types, with sales of the $\frac{3}{4}$ -ton capacity predominating.

Tractor Prospects Better

The manufacture of tractors has not yet been resumed on anything like a real scale, but prospects are growing better as the surplus stocks in hands of makers and jobbers are steadily being wiped out by the much better movement of these machines into farmers' hands. This is being accomplished, of course, through drastic price reductions which are far below immediate replacement value, but opinion seems to be that current reductions probably will hold effect until May 1 or June 1, when production doubtless will have been resumed on a scale sufficient to enable producers to gage true costs on the readjusted basis.

Authentic reports from representative Milwaukee industries indicate that the iron, steel and machinery trade is moving steadily into a stronger position.

Conditions Everywhere Improved, Wollering Says

NEW ORLEANS, March 29—"Conditions the country over, North, South, East and West, are showing improvement, gradually but decidedly," declared Max F. Wollering, vice-president in charge of manufacturing, of the Studebaker Corp., during his visit here as the guest of Fred Perkins, local Studebaker distributor.

Wollering asserted that the country was on the eve of a period of prosperity, and that manufacturers and dealers who exercise the initiative to establish their business on a sound basis will reap big benefits.

HIGHWAY BODY TO MEET

NEW YORK, March 27—Reports of various committees which have been studying different phases of highway transport will be heard at the annual meeting of the National Highway Traffic Association, which will be held at the Automobile Club of America in this city, May 12. The reports will cover regulations relating to speeds, weights and dimensions of motor trucks and trailers; license fees and motor vehicle taxation; and highway transport franchises.

International Trade Improves Materially

Total Shipments 3550 in February Are Almost Equal to Same Month, 1921

NEW YORK, March 27—Overseas shipment of approximately 1350 passenger cars were made during the month of February by the General Motors Export Co. from its plant in Canada. Of this number, a total of 824 were shipped to all parts of the world except to England, to which was shipped between 500 and 600 more, the exact figures for the English shipments not being available here. The totals were announced here to-day by the export company, following the receipt from Washington of the figures for the February shipments from the United States.

The Washington announcement does not include, of course, these Canadian shipments which, added to the total of 3096 announced for the United States, show that the short month of February saw the overseas movement of approximately 4500 automobiles. No month's export sales since January, 1921, have even approached this high figure.

WASHINGTON, March 25—The belief that international trade in automobiles and automotive equipment had improved materially was amply borne out by the February shipments from the United States, the figures for which were announced to-day by the Bureau of Foreign and Domestic Commerce through the automotive division. Striking gains were shown over January, 1922, and for the first time in many months the shipments of automobiles were comparable with those of the same period of the previous year.

The February trade in passenger cars totaled 3096 and trucks 454, a total of automotive vehicles of 3550. The same month in 1921, when the last dispatch was being made on the unfilled orders piled up during the boom years of 1919 and 1920, saw the outbound movement of 3587 automobiles, of which 2492 were passenger cars and 1095 were trucks. The trade by volume in February in this year, therefore, was the largest since January and February of 1921 and almost double that of some of the low months during the latter part of last year. A comparison follows:

Passenger Cars

	No.	Value
Feb., 1922.....	3,096	\$2,556,555
Jan., 1922.....	2,407	2,025,974
Feb., 1921.....	2,492	3,165,170

Motor Trucks

	No.	Value
Feb., 1922.....	454	\$391,738
Jan., 1922.....	464	461,193
Feb., 1921.....	1,095	1,952,736

Exports, Imports and Reimports to Automotive Products for February, 1921 and 1922, and for Eight Months That Preceded

	Month of February—		Eight Months Ending February—	
	1921	1922	1921	1922
	No.	Value	No.	Value
Automobiles, including chassis.....	3,587	\$5,117,906	3,560	\$2,962,135
Electric trucks and passenger cars.....	10	13,842	36	54,967
Motor trucks and buses, except electric.....	1,095	1,952,736	15,499	26,496,400
Up to 1 ton.....	286	117,187	508	2,851,223
Over 1 and up to 2½ ton.....	141	210,264	361	497,735
Over 2½ ton.....	27	66,347	49	123,942
Total motor trucks and buses, except electric.....	1,095	1,952,736	454	391,738
Passenger cars, except electric.....	2,492	3,165,170	75,499	93,476,535
Value up to \$800.....	1,890	958,814	3,220	1,649,879
Value over \$800 and up to \$2,000.....	1,096	1,217,578	2,090	2,273,157
Total passenger cars, except electric.....	2,492	3,165,170	3,096	2,556,555
Parts, except engines and tires.....	3,426,517	*12,138,682	2,838,259	55,699,086
Station and warehouse motor trucks.....	23	14,514	6	11,137
Trailers.....	26	19,230	59	40,233
Airplanes.....	53	386,955	19	126,165
Parts of airplanes, except engines and tires.....	24,213	*22,758	10,146	68,104
Bicycles and tricycles.....	199,705	237	4,783	3,106,761
Motorcycles.....	1,000	333,437	969	259,347
Parts, except tires.....	123	39,774	222	16,673
Gas engines.....	4	6,244	2	4,813
Traction engines, except agricultural.....	881	153,258	2,764	331,479
Automobile engines.....	1	200	1	200
Aircraft engines.....	1,453	1,577,979	6	32,201
Complete tractors, except agricultural.....	1,157	281,592	335	39,395
Other internal combustion engines.....	1,157	281,592	335	39,395
Accessories, parts.....	279,708	164,797	940,144	387,006
Automobiles.....	59	76,181	26	44,960
Parts, except tires.....	81,663	58,495	919	981,274
All other.....	11,192	7,202	392,123	405,274
Imports.....	2,155	3,251,608	2,289	3,482,359
Reimports.....	23	27,720	200	294,357

*Pounds.

Parts

	No.	Value
Feb., 1922.....	2,838,259	
Jan., 1922.....	2,060,619	
Feb., 1921.....	3,426,517	

Thus it is shown that the foreign sales of American automotive equipment are again approaching appreciable levels and that overseas trade is stabilizing itself
(Continued on page 742)

SHORTAGE OF SKILLED WORKMEN

DETROIT, March 25—Shortage of men for skilled positions is taken by the Employers' Association of Detroit as an indication of a return to normal in general business. There is unemployment, the report declares, but mostly of men of no special training. For the week 79 firms report 3273 men employed.

Gray Phaeton, \$490; \$760, Coach Price

Company Has Completed Its Financing and Withdrawn Stock from Sale

DETROIT, March 28—Gray Motor Corp. has fixed the prices on its phaeton and coach at \$490 and \$760 respectively and will get into quantity production on its schedule for 1922 in May. In connection with the fixing of the prices, it was announced that the car will be powered with a 4-cylinder Gray engine and will have Timken axles front and rear.

D. Henry Bonner has been named sales manager of the company. Bonner was formerly in charge of all branch production for the Ford Motor Co. and served latterly as assistant production manager to William S. Knudsen.

President Frank L. Klingensmith, formerly Ford executive vice-president and treasurer, said the company has completed its financing and has withdrawn its stock from sale. The company is capitalized at \$4,000,000 and has sold \$2,600,000 in stock, assuring ample financial strength.

Production in Detroit

All production and assembly of the car for the present will be at the Gray plant in this city. There is a present capacity for 250 engines and 100 cars daily which will be increased in anticipation of 1923 business. Assembly plants in the New York, Boston, Philadelphia and St. Louis districts are expected to be opened before December with others to follow in 1923.

As designed for production, the car will weigh about 1600 lbs. and will have a wheelbase of 100 in. Artillery wood wheels have been substituted for disk as more becoming the lines of the car. Under test the car has travelled 20 miles to the gallon of gasoline and 25 miles per gallon has been fixed as normal expectancy.

The coach type closed car has been selected as most economical to manufacture on a quantity basis. In both open and closed models the body lines have been kept low. The open model has a one-man top. The gearset will be Gray made three speeds forward and reverse. With the exception of body, wheels and axles, the car will be practically a Gray manufactured product.

Material Contracts Placed

Contracts for all material for the complete years production have been placed.

Among the dealers thus far named by the company are: Albert Hirst, New York; Brown Motors Co., Boston; Louis C. Block, Philadelphia; Anderson Strauss Co., St. Louis; Charles E. Baker, Detroit; John S. Keown, Louisville and Edward P. Wilson, Columbia, S. C. All applications for foreign sales rights have been deferred pending the meeting of domestic sales demands.

FORD CUT IN BRITAIN HAS NO U. S. BEARING

LONDON, March 20 (By mail).—Price reductions ranging from \$10 to \$15 (normally from \$50 to \$75) on the various Ford models have been announced here. The biggest cut is on the sedan.

DETROIT, March 28—The Ford Motor Co. said to-day that the reduction of prices in England had no significance so far as the United States is concerned. It was asserted that the drop was based on the January reduction here, which was only \$5 on the phaeton.

Organization of a company personnel will be held to a minimum with Klingensmith in charge of all financial matters, F. F. Beall, former Packard vice-president, in charge of manufacturing and Bonner in charge of sales.

Maxwell Will Build 250 Daily in April

DETROIT, March 25 — Walter P. Chrysler, former executive vice-president of Willys-Overland Co., will devote all his efforts in the automobile field to his work as chairman of the board of the Maxwell Motor Corp.

"We are going to make 250 Maxwells a day in April to meet the steadily growing demand for our product," he said. "Sales are extending all the time as the value of the new lines becomes known. We have now got our organization developed to a point where every detail is properly cared for and, after a year of hard work, we are getting the results hoped for."

Chalmers business in April will show a large increase over former months despite increased price, Chrysler said. There has been considerable business in March due to orders being placed to get in before the increase, he said, but April business already placed will show an increase over March business.

Merchandising plans are being developed whereby the factory will be enabled to co-operate completely with the sales organization in the field in developing Maxwell business. Under this plan, service will be a leading factor and genuine parts will be constantly available to all owners.

TO SELL HARTFORD PARTS

HARTFORD, CONN., March 29—Because of the failure of stockholders and creditors to come to terms on plans for a reorganization, Federal Judge Thomas has ordered the sale at public auction on May 3 of all assets of the Hartford Automotive Parts Co. The upset price has been fixed at \$325,000, not including a mortgage of \$75,000.

Jordan Cut Restores Pre-War Price Level

Reduction Affects All Models But One—Company Plans 1,000 Output for April

CLEVELAND, March 29—Price reductions on the different Jordan models announced by the Jordan Motor Car Co. range from \$300 to \$400. This reduction brings prices back to the pre-war level. Owing to increased production and improvements the cars as produced to-day can scarcely be compared with those of pre-war days, excepting in the matter of price.

The new prices are:

	Old Price	New Price
5-passenger	\$2,095	\$1,795
Playboy Roadster.....	2,095	1,895
6-passenger Sedan.....	3,200	2,785
Brougham	3,200	2,785
Landulet	2,995	2,695

The Playboy roadster is standard equipment with disk wheels, wire wheels being optional; special colors, and nickel lamps furnished. The price of the seven-passenger Jordan models has not been reduced.

Jordan production will approximate 800 this month and the schedule for April is 1000.

TWIN CITY MODEL REDUCED

MINNEAPOLIS, March 24—Minneapolis Steel & Machinery Co. announces a reduction in the price of its Model 12-20 Twin City tractor from \$1,395 to \$1,200.

O'BANNON REORGANIZED

NEW YORK, March 29—The O'Bannon Corp., manufacturer of coated fabrics, which has been operating under a receivership for several months, has been reorganized as the O'Bannon Co. The personnel of the operating departments will remain largely the same, but the company will be under the management of the Russell Co. of Boston.

ASKS OWEN REPAYMENT

WILMINGTON, DEL., March 27—Application has been made by the Wyoming National Bank of Wilkes-Barre, Pa., for repayment by the receivers of the Owen Magnetic Motor Car Corp. of expenses it incurred in having the first sale of the personal property set aside. The amount sought is \$2,960.

MEXICAN CHAMBER FORMED

NEW YORK, March 27—The Mexican Chamber of Commerce of the United States has been incorporated in New York State with the approval of the State Department in Washington. Its object will be to promote business and economic relations between Mexico and the United States by the dissemination of information of mutual interest.

Men of the Industry and What They Are Doing

Mosher Remains as Director

F. E. Mosher, whose resignation as vice-president and treasurer of the Covert Gear Co., Inc., was announced last week, will continue as a director of that company until the annual meeting in August. Mosher, who went with the Covert Gear Co. in 1916 as secretary and general manager, will become assistant to the president and general manager of the Dosch Chemical Co., Inc., of Louisville on April 3. He was made secretary and treasurer of the Covert company in 1919 and the following year was elected to the position which he now is relinquishing.

Hornby with Rickenbacker

Fred Hornby has been appointed superintendent of the final assembling division of the Rickenbacker Motor Co. He was engaged in similar work with the old E. M. F. Co., later joining the forces of the Maxwell Motor Co. in an executive production capacity and subsequently becoming research engineer for the Willys-Overland Co.

Willis Made H. C. S. Sales Manager

Frank B. Willis, who has been prominently identified with automobile factory sales organizations of Michigan and Ohio, his connection at one time being with the Chalmers Motor Corp. as vice-president and with the Saxon Motor Car Corp., has returned to Indianapolis to become general sales manager of the H. C. S. Motor Car Co. Harry Ford, whom he succeeds, is still with the sales organization, and will devote most of his time on the road and in field work.

Elgin Motors Appoints Leach

K. J. Leach, for three years connected with the McFarlan Motor Co. as southwestern district manager and previous to that association engaged in the same work for the Cole organization, has been appointed district representative for the Elgin Motor Car Corp. His territory includes Texas and New Mexico, with headquarters at Dallas.

New Battery Sales Head

W. Melville Taylor, until recently connected with the Philadelphia Storage Battery Co. of Philadelphia, has been appointed to the managership of eastern sales of the Foster, Merriam & Co., Meriden, Conn. E. W. Shepherd, who has been associated with the sales promotion department, is manager of western sales for the company.

Webb Promoting Hinkley Sales

Paul St. Elmo Webb has been added to the organization of Hinkley Motors, Inc., Detroit, as sales promotion manager. Webb's experience has covered a broad

range of service in the field of heavy duty transportation, both as an executive of sales and service and as a transportation engineer with the Diamond T. Truck Co. of Nashville. In his new position, Webb will pay close attention to the application of trucks and buses equipped with Hinkley engines to the various problems continually arising. He will also work in close touch with dealers and distributors of vehicles so equipped who may desire data, information and advice.

Haggott Becomes Field Engineer

William S. Haggott, for several years cable sales manager of the Packard Electric Co., Warren, Ohio, has been transferred from the home office to the field organization of the company in the capacity of field engineer. His headquarters will be in Detroit. Haggott has been prominent in the work of the Society of Automotive Engineers and the Automotive Equipment Association. He is at present chairman of the S. A. E. subcommittee on standardization of automotive cables and represents the society on the cable committee of the American Engineering Standards Committee. The work Haggott leaves at the home office will be absorbed by W. F. Parker, general sales manager, and B. N. MacGregor.

Witherbee, Marko Sales Head

Thomas S. Witherbee has been named general sales manager and director of advertising of the Marko Storage Battery Co. He is a pioneer manufacturer of storage batteries for automobile starting, lighting and ignition. Witherbee has been in the battery business since 1897 and is the inventor and patentee of the Witherbee storage battery igniter, which was produced and sold by the Witherbee Igniter Co., founded by him.

Maloney Joins Parish & Bingham

John E. Maloney, widely known in equipment trade circles, has joined the Parish & Bingham Corp. as assistant sales manager. In assuming his new connection Maloney severs a connection of some ten years with the Hydraulic Pressed Steel Co. and its interests, during the latter part of which he was general manager of the pressed steel end of the business.

Clark Back from Trip

W. W. Clark, export manager of the Hart-Parr Co., has returned from a four months' trip to the Philippine Islands, Australia and intermediate points in the interests of the company.

Swanson Leaves Fox

H. O. Swanson has resigned as chief engineer of the Fox Motor Car Co. of Philadelphia.

Reeves Tours Plants; Surprised at Output

Convinced Production Will Exceed 1921 Greatly—Finds New Spirit Prevailing

NEW YORK, March 29—Genuine surprise at the current volume of production, both of passenger cars and trucks, was expressed by Alfred Reeves, general manager of the National Automobile Chamber of Commerce, upon his return from a two-weeks' trip through the factories in Michigan and Ohio.

While Reeves has been consistently conservative in his estimates of passenger car production for 1922, and believed until he started on his trip that it would not greatly exceed that of 1921, he now is convinced that the total will be considerably larger. He feels no doubt that that truck production will be materially increased.

Conservatism Shown

Concerning conditions, Reeves says:

Everywhere I traveled I found a new spirit among the manufacturers and dealers. Production was increasing; dealers were writing in for cars; some factories were duplicating some of the 1920 figures by train-load shipments to the coast and elsewhere; more than 3,300 additional men were added to the payrolls in Detroit in one week and in some cities there was an actual shortage of experienced automobile workers, although still a large surplus of unskilled labor.

Notwithstanding all this, the makers are going along with a spirit of conservatism and with no idea that the spring business will continue for the remainder of the year, although with every indication that the last six months would be better than the same period of 1921.

The big keynote for this year is going to be the dealer and that manufacturer will succeed best who spends money to back his dealer into better financing, selling and general business methods.

Any plan the manufacturer contemplates should be predicted entirely on whether it is going to be best for his dealers. I don't believe we will ever have an opportunity again to build up dealers as we have during the past and each one lost now will cost a great deal of money to replace.

RECEIVER FOR HALLADAY

NEWARK, OHIO, March 29—A receiver has been appointed for the Halladay Motors Corp., which is capitalized at \$400,000. The proceedings were instituted by the Barber Asphalt Paving Co. of Pennsylvania. The motors company admitted its obligations and joined in the petition for the appointment of a receiver. Edward Kible, an attorney, was appointed, and his bond was fixed at \$30,000. The Halladay company came here three years ago from Attica, Ohio, and was heavily financed by Newark residents.

Goodyear Tire Shows Profit of \$9,640,235

Ratio of Current Assets to Current Liabilities Is More Than Ten to One

AKRON, March 27—For the first ten months of operation of the Goodyear Tire & Rubber Co. of Akron under the financing control which succeeded the Seiberling régime under the company's reorganization and \$85,000,000 refinancing program, sales totaled \$82,195,550, while a net profit of \$9,640,235 is reported, according to the annual Goodyear statement made public to-day by President E. G. Wilmer. The report is for the ten-month period ending Jan. 1, 1922.

The \$82,195,550 in sales are exclusive of all subsidiary companies and compare with sales of nearly \$205,000,000 in 1920 for Goodyear under the presidency of Frank A. Seiberling, founder of the company. During the last year of the Seiberling régime, however, due to heavy losses on commitments, a deficit of \$15,647,653 was reported.

Net Balance of \$3,620,043

After deduction of interest and fixed charges, including miscellaneous adjustments in respect of investments in subsidiary companies, there remained out of the net profit of \$9,640,235 a total net balance to surplus of \$3,620,043, according to President Wilmer's report. Cash and the United States Treasury certificates are listed at \$23,892,820. Although current liabilities included accrued interest and premium on bonds amounting to \$1,371,574, the ratio of current assets to current liabilities is more than ten to one, Wilmer announces.

The adjustment in respect to investments in subsidiary companies, aggregating \$1,508,820, in a large part reflects additional write-downs of inventories in both domestic and foreign subsidiary companies to a basis dictated by current market values, as well as substantial losses in the export business due to depressed exchange.

The Goodyear Tire & Rubber Co. of California and the Goodyear Tire & Rubber Co. of Canada, Limited, the company's principal operating subsidiaries, continue to show satisfactory current earnings, and the company's export business has been restored to a profitable basis, Wilmer reports. Neither the parent company nor any of its subsidiaries to-day has any bank indebtedness.

Officers Re-elected

All officers are re-elected, while three new directors are added. These are Francis Seiberling, Akron attorney, cousin of F. A. Seiberling and legal counsel for Goodyear under the Seiberling régime; Russell L. Robinson of the Robinson Clay Products Co. of Akron, and H. H. Springford, assistant to the president.

Old directors re-elected include Roger

Hyatt, Paul W. Litchfield, G. M. Stadlerman, Grayson M. P. Murphy, Robert Schaffner, Armin A. Schlesinger, A. H. Scoville, G. P. Steele, and Ralph Van Vechten. Stadlerman and Litchfield are vice-presidents, having served in similar capacities under Seiberling and being the only old Seiberling executive officers to remain under the Goodyear reorganization. Litchfield is factory manager.

Executive officers are E. G. Wilmer, president; G. M. Stadlerman and P. W. Litchfield, vice-presidents; H. H. Springford assistant to the president; P. H. Hart, treasurer; P. R. H. Leroy, assistant treasurer; C. A. Stillman, secretary; W. D. Shiltz and C. F. Stone, assistant secretaries; C. H. Brooks, comptroller, and C. L. Weberg, H. D. Hoskin and A. F. Eggleston, assistant comptrollers.

California Subsidiary Report

AKRON, March 25.—The Goodyear Tire & Rubber Co., of California, a subsidiary of the Goodyear Tire & Rubber Co. of Akron, which started operations at Los Angeles in July, 1920, as the first major tire factory on the Pacific Coast, in the ten-month period ending Dec. 31, 1921, reduced its net deficit from \$3,157,762 to \$1,672,453 by applying thereon the company's net earnings for the same period, which totaled \$1,485,309, according to the annual report of the California company.

The western company, President E. G. Wilmer states, is in a strong position financially, at present the ratio of current assets to liabilities being approximately 13 to 1. The company lists current assets of \$7,045,952 and current liabilities of only \$538,935. The company has wiped out its bank indebtedness and announces that all trade accounts payable are being currently discounted.

Total net sales for the California company for 1921 were \$14,333,500, compared with \$16,128,850.

This Will Be Better Year Than 1921, Bank Asserts

MILWAUKEE, March 27—"This will probably be a somewhat better year in the automotive industries than last year," is a significant statement in the current issue of *Business and Financial Comment*, monthly business review issued by the First National, the largest bank in this city. It goes on to say:

Because agricultural prospects are looking up, the demand for tractors and farm implements bids fair to improve. The leading makers of farm machinery have made drastic reductions in prices in order to get down to the level of farm purchasing power, although severe competition among manufacturers also is partly responsible.

Assuming that a tractor lasts on the average six years, the replacement demand in the present year would not be much over 10 per cent of possible manufacturing capacity, figuring that in 1920 a total of 200,000 tractors were produced. The tractor manufacturing business, therefore, is dependent to a very large extent upon the development of new demand. In the motor car business, by contract, replacement demand has come to be a much more important factor.

M.A.M.A. Group Plan Will Be Abandoned

Directors Base Action on Policy and Expediency—Long Released from Duties

NEW YORK, March 28—Directors of the Motor and Accessory Manufacturers Association have decided, on the ground of policy and expediency, to abandon the group plan of organization for manufacturers making products of the same general character. Notices have been sent to members informing them of the action taken.

Considerable progress has been made in developing this form of organization and associations whose members produced springs, sheet metal, wood wheels and headlights had been taken into the M. A. M. A. as groups. The latest to affiliate were the makers of headlights, who acted during the Chicago show, and the Automotive Wood Wheel Manufacturers Association, which voted during the New York show to dissolve its organization.

Long Was Named Manager

After the wheel makers came in, Hargrave A. Long of Chicago, who had been secretary and treasurer of their association, was appointed manager of the industrial group department of the M. A. M. A. He has now been relieved of these duties and will return to Chicago.

No information is available as to whether the associations which were dissolved to continue the same general activities with the M. A. M. A. will be reorganized. No statement has been made by the directors of the M. A. M. A. as to the motives which prompted their decision to abandon the group plan. It is understood, however, that it was felt it would prove unwieldy. The nebulous state of the Federal law in relation to trade association activities also is believed to have had some bearing on the action.

N. A. C. C. Asks Distribution of Data in Foreign Fields

NEW YORK, March 27—The foreign trade committee of the National Automobile Chamber of Commerce has asked export managers of member companies to co-operate in the distribution abroad of information which will stimulate interest in the use of American motor vehicles. One purpose will be to familiarize foreign countries with the various utility uses to which motor vehicles are put in the United States.

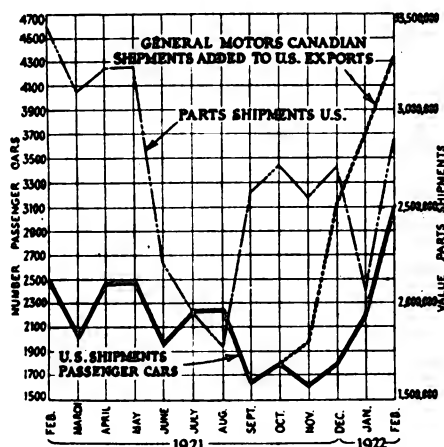
Information on road development also would prove acceptable, it is believed. This campaign will be conducted through export managers and their dealers abroad. In preparation for the work, members of the chamber have been asked to submit suggestions and lists of foreign cities in which they are represented.

International Trade Improves Materially

Total Shipments 3,550 in February Are Almost Equal to Same Month, 1921

(Continued from page 738)

in line with the post-war development in industry and agriculture. New orders have come through from many territories where the stocks of cars and equipment have been sold out, necessitating new purchases to meet current demands. These demands throughout most of 1921 were met by the stocks sent through immediately after the boom broke and, as these stocks have now disappeared in numerous centers, shipments are necessary to keep cars on the dealers' floors and equipment in the stockrooms and warehouses.



The upward swing of passenger car exports

Details of the February shipments are shown in an accompanying table, and the chart herewith reveals how the overseas trade is again building up to a higher volume. The month of February was notable in an upswing of exchange for practically all countries of the world, except for the former enemy and the new succession states of Europe, and the rise naturally was accompanied by heavier shipments.

Some Recessions in Exchanges

Since the month closed, some recessions have been made in these international currencies, but March is closing with most of them at or within a small percentage of the high point reached in the earlier upswing. Consequently, except for the seasonal variations that may be expected from the various buying territories, there seems little doubt but that the shipments will hold up or grow larger as the better business situation makes itself more clearly felt throughout the world.

The February shipments continue the improvement begun some months ago, as the following comparison of shipments during the last year will show:

1921	Passenger Cars	Trucks	Parts
Feb.	2,492	1,095	\$3,426,517
March	2,019	606	3,097,890
April	2,469	609	3,195,734
May	2,479	462	3,204,723
June	1,964	418	2,211,528
July	2,224	339	1,952,525
Aug.	2,237	381	1,786,886
Sept.	1,631	239	2,570,860
Oct.	1,791	254	2,702,002
Nov.	1,616	226	2,546,424
Dec.	1,784	161	2,683,850
1922			
Jan.	2,407	464	2,060,619
Feb.	3,096	454	2,838,259

In addition, the General Motors group have announced the shipments from Canada of the following number of cars not shown on the U. S. totals: November 371, December, 1338 and January 1300.

Denver Dealers Survey Cost of Doing Business

DENVER, March 25—A survey of the cost of doing business in the wholesale and retail automobile and truck fields has been undertaken by the Denver Automobile Dealers Association. The survey is being conducted separately for the distributor organizations of Denver and the dealer organizations of the Rocky Mountain territory. The work is being directed by the extension division of the University of Colorado.

The university is sending to Denver distributors and Rocky Mountain dealers questionnaires covering several pages, on which they are requested to give detailed information regarding total investment, total sales for 1921, sales of used cars, parts and sundries, repair labor, etc.

Another division of the questionnaire requests information as to the relationship in percentages of total sales to the cost of salesmen's salaries, advertising, sales management, commissions, salaries, instructions and sales expense, traveling, administration, guarantee expense, etc.

Other divisions ask for information regarding administrative and fixed expenses, with a recapitulation of the percentage relationship of selling expense in every department to the sales of that department and of administrative and fixed expense to the total sales.

April Will Surpass March in Business

(Continued from page 732)

basis. They have learned that the agricultural districts will take a considerably larger number of vehicles than was thought possible only two or three months ago. The same is true of the export field.

Sane and intensive sales efforts are being made. Greater attention than ever before is being given to service questions and economy of operation. The industry now realizes that the buying public is "motor wise." This is an important factor when it is considered that a very substantial part of the business this year will be in replacements.

Owen Tire Insolvent, Receiver Tells Court

Files Statement Showing Assets of Company Are \$713,245 and Liabilities, \$987,597

CLEVELAND, March 26—The assets of the Owen Tire & Rubber Co., of this city, are placed at \$713,245 and the liabilities at \$987,597 in a statement filed in the United States District Court here by M. M. Scott, receiver.

More than 150 pages of claims against the company are included in the report, most of the claims being for small amounts.

The company was organized during the war and got into production when trade in the industry slumped. Before the filing of an involuntary petition for bankruptcy in the Federal Court, the company had made certain transfers of property to creditors. It was claimed these were undue preferences and that the company at the time the transfers were made was insolvent.

Referee Made Report

C. D. Friebolin, referee in bankruptcy, was made a special master and, after conducting an investigation, reported that the company was insolvent in July and August, 1921, at the time the transfers were made. He also recommended that the petition for the adjudication of the company as a bankrupt be granted.

Because of this all creditors of the company will share on equal terms in the assets of the corporation.

Among the assets listed are accounts receivable of \$11,176; accounts receivable, personal, \$1,000 and notes and trade acceptances of \$4,000. The liabilities include, in addition to claims reaching as high a figure as \$587,168, note and trade acceptances, \$39,448; trade acceptances, secured, \$15,000, and acceptances payable of \$100,000.

Time Payment Figures Show Sales in Chicago

CHICAGO, March 27—Figures compiled by the Central Auto Finance Association of Chicago show the steady increase in the sale at retail of automobiles in Chicago and Cook County since Jan. 1. The figures are based on time sales as indicated by the number of chattel mortgages on automobiles filed with the county recorder. C. L. Wolf, secretary of the association, estimates from long study of the automobile financing business that the time sales, including truck sales, represent about 75 per cent of total sales.

The number of chattel mortgages filed by weeks ending on given dates follows: Jan. 7, 302; Jan. 14, 410; Jan. 21, 458; Jan. 28, 442; Feb. 4, 493; Feb. 11, 442; Feb. 18, 517; Feb. 25, 486; March 4, 524; March 11, 719, March 18, 873.

Wolf said that within the last few weeks the records indicate a substantial increase in the sale of trucks.

Sales in New York Far Exceeding 1921

**In Cases They Triple Business—
Cars Below \$2,500 in Price
Take Big Jump**

NEW YORK, March 27—Passenger car sales in the New York territory are following a normal curve for early spring, with the March sales records running with some cars almost twice what they were in February, and with all makes substantially ahead of last month. The indications are plain that the metropolitan trade will have at least a good spring business, and there are some pointers to a larger volume than dealers anticipated when the year opened.

Fifteen makes of cars are running far ahead of all others in their price classes, and 15 others are making what might be termed good sales records. Sales in the remaining classes are low.

In the aggregate, sales in the metropolitan area for the first three months of the year will run between two and three times the total for the same period of 1921.

County Figures

New passenger cars registered in 10 counties in and around New York numbered 4806 in January and February, as compared with 2247 in the same months last year.

Registration figures compiled by Sherlock & Arnold, publishers of the Automobile Sales Analysis, largely subscribed to by dealers, may be tabulated as follows:

Cars Below \$2,500			
	1922	1921	
January	2,019	483	
February	2,231	1,409	
Total	4,250	1,892	
Cars \$2,500 and Above			
	1922	1921	
January	283	273	
February	145	210	
Total	556	355	

Pulcher Elected Head of Truck Association

DETROIT, March 27—Martin L. Pulcher, vice-president and general manager of the Federal Motor Truck Co., was elected president of the new National Association of Motor Truck Industries at a meeting here this week. The purpose of the association is to improve conditions existing in the motor truck industry.

H. T. Boulden, vice-president of the Selden Truck Corp., was elected first vice-president; B. A. Gramm, vice-president of Gramm-Bernstein Motor Truck Corp., second vice-president; Moie Cook, secretary of the Service Motor Truck Co., secretary; A. S. More, president, Denby Motor Truck Co., treasurer. Don F. Whitaker, former general manager of the National Association of Motor Truck Sales Managers, which is merged into

the new association, is retained as manager of the new organization.

These officers, with J. W. Stephenson, vice-president of the Indiana Truck Corp.; Homer Hilton, vice-president of Winther Motors, Inc.; F. G. Elder, vice-president of the Day Elder Motors Corp. and J. E. Tracy, vice-president of the Parker Motor Truck Co., comprise the board of directors.

Files Petition Asking Receiver for Harley Co.

BOSTON, March 30—A petition asking the appointment of receivers for the Harley Co. of Springfield, manufacturer of castings, has been filed here by Frank D. Zell of Philadelphia. He also asked an injunction to prevent the company from paying out any money while the proceedings are pending. The petition asserted that the company is solvent, but that its assets are likely to be dissipated by attachments by creditors. The plant is said to be worth approximately \$1,000,000.

It is stated authoritatively that the action was taken to avert attachments and the foreclosure of a mortgage for \$725,000 held by the Hendee Mfg. Co. The company is said to have quick assets of more than \$200,000, and that its debts, exclusive of the mortgage, do not exceed \$100,000.

Announcement was made on Jan. 4 of the transfer of the Harley Co. from the Hendee company by a syndicate headed by A. W. Morris and including R. E. Northway. The consideration was said to have been \$1,100,000.

Industry Expansion Wide in Canada During 1920

OTTAWA, ONT., March 27—A preliminary report covering the automotive industry for 1920 has just been issued by the Dominion Bureau of Statistics, showing that during the year there was great expansion in the industry in each of the three sections under review.

Manufacturing firms increased their output from \$80,619,846 in 1919 to \$101,465,846 in 1920; automotive supply and accessories from \$8,571,890 to \$19,361,882 and repair plants from \$12,004,970 to \$16,592,623 or an increase of \$36,223,645 for the three sections. Total capital invested was \$89,183,306.

There were 3,759 open 2-3-passenger cars constructed at a value of \$3,270,319; also 67,319 open 4-7 passenger cars valued at \$65,084,212; closed cars numbered 7,957 valued at \$9,721,247 and chassis, 4,601 valued at \$2,407,206; trucks under 1-ton, 546 valued at \$535,732 and over 1-ton 9,628 estimated at \$7,617,785 with 334 specials, \$75,220; 4-cylinder engines numbered at 54,121 and 6-cylinder, 4,904.

ENGINEER SUES FORD

MIAMI, FLORIDA, March 30—Damages amounting to \$11,000,000 are asked in a suit filed here against Henry Ford by Edward S. Huff, an electrical engineer. Huff asserts that he originated the magneto now in use on Ford cars and that he never has been paid in full for his invention.

Miniger Will Offer to Buy Auto-Lite

Proposal Is Now Being Considered by Creditors' Committees of Willys Corp.

TOLEDO, March 29—Clement O. Miniger, one of the receivers for the Willys Corp., will make an offer to the Federal court for the Electric Auto-Lite division, with plants here and at Fostoria. The amount of the bid has not been determined, but the proposal now is being considered by committees representing bank and merchandise creditors.

Miniger, who has been a vice-president of the Willys Corp. and general manager of the Electric Auto-Lite plant, probably will have several associates in the deal, but he declines to name them. Several weeks must elapse before the negotiations can be completed, as advertisement for 30 days is required under the Ohio law. Miniger now is a director in two or three companies, which are subsidiaries of Durant Motors, Inc.

The general plan for the liquidation of assets of the Willys Corp. includes the sale of the properties now being operated and later liquidation of securities owned by the corporation. The Auto-Lite division has been the most profitable of the properties owned by the Willys Corp. The liability of the division to the Willys Corp. has been fixed at \$5,405,596. The division now employs about 2000 men and has made preparations to add 300. Profits from operations in February amounted to \$167,206 and for January to \$158,881. Cash on hand amounts to \$655,636 and the net current assets to \$4,129,616. The total assets are \$6,573,813.

S. A. E. Hears Electric Wiring Standard Favored

BUFFALO, March 25—Standardization of electric wiring for automobiles was advocated by W. S. Haggott of the Packard Electric Co. of Detroit at a meeting of the Society of Automotive Engineers held here.

"In conformity to the general tendency to standardize motor parts," Haggott said, "it is proposed to consider plans for a standardization of the electrical wiring of different automobiles, particularly wire and cable construction and methods of installation. Two years have already been spent in designing suitable cable."

He continued to say:

The wiring of an automobile is different from the wiring in a house or a factory. Tendency is strongly toward the use of braided covered high-tension cable, the braid, being filled with a good baking varnish. It is preferable to run high-tension wire open. There is a tendency to use armored cable on lighting circuits.

The use of a main line circuit breaker is strongly advised. Standard color schemes for various circuits should be used by all manufacturers of automobile wires.

BANK CREDITS

Written exclusively for AUTOMOTIVE INDUSTRIES by the Guaranty Trust Co., second largest bank in America.

Call money was easy both at the beginning and the end of last week. On Tuesday, however, rates began to rise and held up until Friday, when the tendency was downward. This rise was attributed principally to the action of the interior banks, especially in the Middle West and Canada, in recalling funds from this center. There were also rather heavy withdrawals of Government deposits from New York banks.

The quotations for call money ranged from 3½ per cent to 5½ per cent, as compared with 3 per cent to 4 per cent in the previous week. There was no essential change in time money rates, the quotations being 4½ per cent for 60-day maturities and 4½ per cent to 4¾ per cent for 90-day and four, five and six months' maturities, as against 4½ per cent for 60 and 90-day, and 4½ per cent to 4¾ per cent for four, five and six months' in the previous week. Trading was reported as dull and featureless, and although offerings were plentiful no large transactions were recorded. Prime commercial rates were quoted at a new range, from 4½ per cent to 4¾ per cent. For the previous two weeks, the rate was 4¾ per cent, and previous to that the range of 4¾ per cent to 5 per cent had been ruling since Jan. 10.

The Federal Reserve statement as of March 22, 1922, showed an increase of \$681,000 in gold reserves and \$3,213,000 in total reserves. The total reserves of the New York institution increased \$26,399,000 and the gold reserves \$27,402,000.

The U. S. Steel Corp. is reported to be now operating at 70 per cent of capacity, and incoming business thus far in March is 30 per cent in excess of that for February. In July, 1921, operations were 29 per cent of total capacity.

On March 23 German marks reached a new low level for the year, and the lowest point in history at 29½ one-hundredths of a cent. This downward trend was attributed in some quarters to a feeling that recent developments in the reparations situation might react unfavorably on German finance.

G. M. Declares Dividend Upon Its Preferred Stock

NEW YORK, March 29—Directors of the General Motors Corp. at a meeting here yesterday declared the regular quarterly dividend upon the preferred and debenture stocks. The dividend on the common again was passed.

At the close of the meeting the following statement on the business outlook was made by Pierre S. duPont, president of the corporation:

The position of the corporation is very satisfactory to us. Bank loans, which now stand at \$41,140,000, have been reduced \$7,800,000 since the beginning of the year, and cash, which now stands at \$37,000,000

decreased only \$3,000,000, making a net improvement in cash position of \$4,800,000.

While it may be several weeks before final figures of sales of motor cars for the first quarter of 1922 will be available, the preliminary figures are most encouraging. Sales for January were 16,080; February, 20,664 and sales for March will be approximately 30,000 cars, a total of 66,000. This compares with 58,488 cars in the previous quarter and, further, with 30,023 for the first quarter of last year.

All divisions of the corporation are enjoying a substantial increase in business, and reports from our distributors and dealers indicate a strong retail demand for our product this spring and summer.

Seek to Keep Kentucky Wagon Firm from Merger

LOUISVILLE, KY., March 29—Following the filing of two suits in Circuit Court by four minority stockholders for a receiver and for an injunction to prevent the merger, plans for the merger of the Kentucky Wagon Manufacturing Co. with several other similar plants over the country have been practically completed, it was announced to-day.

The receivership proceedings were begun by J. Hardin Ward, Wilfred Bowser and Ossian P. Ward, plaintiffs in one petition, and C. D. Karsner, plaintiff in the other. Attorneys would not say when the matter will be taken before one of the chancellors for a hearing.

The petitioners alleged that the outstanding indebtedness of the corporation, including mortgage liens, notes and other forms of indebtedness, approximate \$3,450,000, while the officers of the company claim the full extent of its liabilities is only \$2,600,000 and that its tangible assets total \$5,000,000.

It was said that James R. Duffin, a guiding hand in the merger, is now in the East closing a deal for the transfer of the cash, and that the money will be on hand before the time expires whereby the corporation will have to make a legal reply to the petition of the stockholders.

Tractors in New England Prompt Course by College

NORWICH, CONN., March 27—Rapidly increased use of the tractor on New England farms and in the rural districts is indicated in the announcement that a brief course on the management and use of the tractor has been scheduled for this spring at the Connecticut State College at Storrs. This institution is the recognized agricultural institution of the state.

The course, to comprise two lectures daily, followed by laboratory work and augmented by practical talks by experts on oiling systems, ignition systems and the like, will be inaugurated April 11.

FORD AT SOUTHAMPTON

NEW YORK, March 30—A dispatch from Southampton, England, states that representatives of Henry Ford have agreed to purchase from the city government a site for an automobile factory to cost £500,000.

FINANCIAL NOTES

Advance Rumley Co. in its annual report for the year ended Dec. 31, 1921 shows gross profits from operations of \$1,353,452 compared with \$4,971,129 in 1920. After allowing for all expenses, inclusive of selling and administrative costs, bond interest and inventory adjustment, there was a net loss for the year of \$1,964,215 against a net profit of \$1,277,231 the year before. The loss was stated to be due solely to conditions in the agricultural districts. The company's inventories have been reduced from \$10,489,972 at the close of 1920 to \$6,937,004 at the close of last year. In the previous year the company wrote off inventory to the extent of \$837,936 and in 1921 to the amount of \$1,279,197.

Republic Motor Truck Co., Inc., consolidated balance sheet as of Dec. 31, 1921, shows cash as \$260,186 against \$493,281 in 1920; notes and accounts receivable, \$519,909 compared with \$773,878; inventories as \$3,842,995 against \$6,612,392; notes payable, \$1,562,149 compared with \$2,029,873; and accounts payable, \$571,697 against \$486,779.

Hupp Motor Car Corp. for the year ended Dec. 31, 1921 reports net profits of \$890,278 after Federal taxes and other charges. This amount is equal to \$1.59 a share on the common stock after allowing for the preferred dividends. There is outstanding \$5,192,100 common stock of \$10 a share par value.

Republic Motor Truck Co. committee for first mortgage and collateral trust 7 per cent serial notes has announced that the time for the deposit of notes had been extended until April 5, 1922. The noteholders' committee states that on March 21 notes to the amount of 80 per cent had been deposited with it.

McGraw Tire & Rubber Co., directors at a meeting here, decided not to do any new financing for the present. While the company lost money in February it is breaking even in March, with the prospects much better for April, judging from orders already booked.

Chicago Yellow Cab Co., Inc., has declared a monthly dividend of 60 cents a share payable April 1 to stock of record March 23, 1922. Previous payments were at the rate of \$1.75 quarterly.

Empire Trust Co. has been appointed depository for claims against Consolidated Distributors, Inc., under an agreement entered into March 10.

Reo Motor Car Co. has declared the regular quarterly dividend of 2½ per cent, payable April 1.

Motor Transport Future Is Outlined to Students

BOSTON, March 27—The prediction that 4000 specially trained men will be needed in the next ten years for service in the highway transport business, was made by F. W. Fenn, secretary of the motor truck committee of the National Automobile Chamber of Commerce, in an address before the students of the Massachusetts Institute of Technology.

Fenn said during his talk:

It is fairly certain that the next great development in this country in transportation will be therefore a national delivery service for picking up traffic at the point of origin and making delivery at the store door of the consignee. The motor truck offers the best solution of this problem in the opinion of many railroad officials.

INDUSTRIAL NOTES

International Steel Products Co. stockholders at a special meeting instructed the directors to take immediate steps looking to the disposition of the property. The company was organized in 1918 to manufacture mufflers and built a two-story modern factory. The decline in the commercial muffler market obliged the company to enter other lines, but while a fair business was done in 1921 the losses of the previous year were not overcome and stockholders declined to invest the additional funds required to maintain it as a going institution. The property will be offered for sale Saturday, April 15, at 2 p. m., at the plant offices in Hartford, Wis.

Master Tire & Rubber Co. reports that for the six months' period ending Feb. 25 it had manufactured 13,400 tires, a greater output than it has before produced in a like period. It states that these tires have met a ready sale at a reasonable profit to the company, with the profit and loss statement showing a very substantial net profit for this period. It also states that there is every reason to believe that the company will work out of its receivership with a stronger dealer organization and with its position better than ever before.

Wisconsin Castings Co., Sheboygan, Wis., has been incorporated with a capital stock of \$125,000 by Harry W. Bolens, president of the Gilson Manufacturing Co., Fort Washington, Wis., who recently purchased at receiver's auction the foundry and machine shop of the defunct Globe Metal Products Co. for \$65,000. The Globe plant will be placed in operation as soon as readjustments and improvements can be made and will be devoted largely to manufacturing parts as well as complete farm tools and specialties.

Montana Tractor Co., Oconto, Wis., has elected John B. Chase, mayor of Oconto, president to fill the vacancy caused by the death of George Beyer. The Oconto factory was established about two and a half years ago by the concern, then located at Tyndall Park, near Chicago. Oconto stockholders gradually have taken over the ownership and have now made disposition of the Tyndall Park factory to other interests in order to concentrate production and administration at the main works in Oconto.

Starkweather-Snook Corp., Moline, Ill., has increased its capitalization from \$100,000 to \$200,000 with local bond houses underwriting the issue. The S. and S. shock absorber has been on the market for four years and a dozen agencies have been established from coast to coast. The new capitalization will provide facilities for the growing business and is the first move toward enlargement of the plant.

C. A. Shaler Co., Waupun, Wis., has made preliminary plans for the construction of a new plant to replace its works, destroyed by fire recently. These plans call for an ell-shaped structure, 50 x 300 and 50 x 150 ft., of brick and steel construction, with steel sash, fireproof throughout. Work will be put under way at once. The investment in buildings and machinery will be about \$300,000.

Multibestos Co., Walpole, Mass., stockholders have elected C. W. Bunker treasurer of the company. The officers and executives are now as follows: Stoughton Bell, president; C. W. Bunker, treasurer and assistant to the president; T. J. Daley, secretary; T. H. Bateson, superintendent; E. C. Miner, assistant sales manager; J. Posternock, purchasing agent.

Lee Rubber & Tire Corp. re-elected directors at the annual stockholders' meeting.

The company reports that its production since Jan. 1 has been at the rate of 2000 tires a day, which compares with 500 tires daily at this time a year ago. It also reports an improvement in sales.

Jelly Electrotube Battery Co., Inc., New York, has been placed in the hands of Joseph C. Bonner as receiver. The company, which manufactures storage batteries, has filed a petition in bankruptcy listing its liabilities as \$52,654 and its assets \$18,481.

A. J. Gillespie & Co. has been established at Cleveland for sales engineering service. The service will embrace both the executive and sales branches of industries and, in addition, direct sales representation for automotive products will be undertaken.

Oakland Motor Car Co. has changed its San Francisco distributorship into a direct factory branch with its territory including northern California and western Nevada. L. S. Shoup, formerly Oakland branch manager at Indianapolis, will be branch manager.

Laher Auto Spring Co. is contemplating the erection of a new factory at Spokane for the manufacture of automobile springs. The site for the plant has not been selected.

New Company to Make
"No Ceem" Inner Tube

NEW YORK, March 27—The Corrugated Rubber Corp. has been organized to manufacture the "No Ceem" corrugated inner tube, a product which is described as being "moulded in one perfect ring oval in cross section, without splices, seams or creases." The tube is corrugated on the outside to facilitate circulation of air between the tube and shoe and to prevent sticking. Headquarters of the company will be in New York and a plant will be erected at Poughkeepsie.

The company is capitalized at \$1,500,000. W. L. Fairchild, inventor of the process by which the tube will be made, will be vice-president. The Edward A. Cassidy Co., manufacturers' sales agent located in New York, will distribute the product.

Sounding Out Executives
On Export Combine Plan

NEW YORK, March 25—Regional meetings of automotive executives at New York, Detroit, Chicago, Cleveland and perhaps other centers are being planned and soon will be held for consideration of the export combine under consideration by the National Automobile Chamber of Commerce.

All member companies of the N. A. C. C., as well as their foreign sales managers and other companies interested in the proposal, have been furnished a prospectus of the combine plan and the trade is quietly being sounded out concerning its possible adoption in preparation for the forthcoming meetings. Some modifications of the plan as it was originally presented last January, principally referring to the financing of international shipments, have been made in an effort to clarify it.

Promotion work in regard to the proposed combine is under the direction of a committee headed by A. S. More, president of the Denby Motor Truck Co. of Detroit, and George F. Bauer, foreign trade secretary of the Chamber.

METAL MARKETS

APPARENTLY the chief steel market interest approves of the advance in sheets which a number of independents have notified the trade would become effective April 1. Judge Elbert H. Gary's recent statement to the effect that "It will be our principle and policy to follow increases in the selling prices of others up to the point which we believe will be fair and reasonable and just to the purchasers and not any further" is interpreted to mean that the corporation's subsidiaries will shortly revise their prices upward to the levels recently announced by the independents. Brier Hill Steel Company, Wheeling Steel Products Company, and other independents who announced the advance of black sheets to 3.15c., galvanized to 4.15c. and full-finished automobile sheets to 4.50c., effective April 1, took special pains to afford to the trade every possible opportunity to place orders at the old prices, which were \$3 a ton lower.

It is safe to say that the bulk of the sheet business for the second quarter has been placed at the previously prevailing figures of 3c. for black, 4c. for galvanized and 4.35c. for full-finished automobile sheets. Undoubtedly intimation of the advance has resulted in adding to the backlog of nearly all the mills. Until a representative tonnage of orders has been placed at the new prices it would be premature, however, to pass any sort of judgment on the market's tone. What has taken place so far is simply that the mills have revised their asking price on sheets upward to the extent of \$3 a ton. There has been no buying at the new levels.

Of course, it will be well to bear in mind that the present movement differs from previous attempts to elevate steel prices to somewhat higher levels, in that it appears to have the full support of the leading interest. It may also be well to bear in mind that the corporation's judgment affecting price policy is always based upon a survey of the probabilities in the way of demand rather than upon sentiment. From the producer's point of view the market has turned the corner, which impression is based on the unanimity of sellers in asking higher prices. From the consumer's point of view the new prices are still on trial.

Pig Iron.—General demand is expanding. Automotive foundries continue to buy conservatively. So far the market is steady rather than strong.

Steel.—Announcement of impending advances in sheets was preceded by a \$2 advance in sheet bars to \$31. In this the principal corporation subsidiary, the Carnegie Steel Co., took the lead. There has been a slight let-up in specifications on strip steel by automotive buyers, especially on the hot-rolled. Orders for cold-drawn steel bars are larger, many buyers apparently believing that sooner or later the price for this product must be affected by the higher tendency of the basic product, ordinary steel bars. Somewhat more firmness is noted in the market for bolts and nuts.

Aluminum.—The undertone of the market is firmer and 17.50c. has now come to be an inside price for foreign virgin ingots, 98 to 99 per cent. American metal has been resold at 18.50c., which is also the level at which small tonnages of British ingots changed hands. The supply of German metal has somewhat increased, interests which for a time were out of the market again offering metal. Sheets are in fair demand at steady prices.

Copper.—Domestic demand is very quiet. The market is again easier.

Calendar

SHOWS

April 3-16—New York, Second Annual Electric Automobile Show, Showroom of the New York Edison Co.

FOREIGN SHOWS

March 10-July 31—Tokio, Japan, Peace Exhibition.

April 16-23—Mexico City, Annual Automobile Show, Auspices of the Automotive Division of the American Chamber of Commerce.

April 22-May 1—Prague, Czechoslovakia, Fourteenth International Automobile Exhibition.

May—Shanghai, Exhibition of Road Building Material.

May, 1922—Quito, Ecuador, Agricultural Exposition, celebrating Centenary of Ecuador. Automotive Section.

May 1-15—The Hague, Automobile Show, also Airplanes and Motorboats. Secretary, Spui 185, The Hague.

May 6-21—Scheveningen, Automobile Show.

May 24-June 5—Barcelona, Spain, Automobile Show under Dealers' Direction.

May, 28-June 5—Prague, Motor Show, Hotel de Ville.

July 1-24—London (Olympia), Aircraft Exhibition.

Sept. 1922—Rio de Janeiro, Brazil, Automobile exhibition in connection with the Brazilian Centenary Association Automobilista Brasileira.

Sept. 15-20—The Hague, Automobile Show.

September—Buenos Aires, Argentina, Annual Exhibition, Sociedad Rural Argentina.

Oct. 12-23—London (Olympia), International Commercial Vehicle Exhibition.

November—London (Olympia), Automobile Show.

Nov. 10-Dec. 19—Brussels, Automobile Show, Palais de la Cinquantenaire.

Nov. 29-Dec. 4—London (Olympia), Cycle and Motorcycle Show, British Cycle Motors, The Tower, Warwick Road, Coventry.

November—Buenos Aires, Argentina, Annual Exhibition, Automovil Club Argentino.

CONVENTIONS

April 4-5—Boston, Safety Conference, under auspices of Massachusetts Safety Council, State House.

April 20-22—Buffalo, N. Y., Sixth Annual Convention of the American Gear Manufacturers Association.

May 8-10—New York, National Association of Manufacturers.

May 10-12—Philadelphia, Ninth National Foreign Trade Convention of the National Foreign Trade Council.

May 12—New York, Annual Meeting, National Highway Traffic Association, at the Automobile Club of America.

May 16-18—Washington, D. C., Annual Meeting of the Chamber of Commerce of the United States.

June 11-15—Milwaukee, Annual International Convention of the Associated Advertising Clubs of the World.

June 19-24—Colorado Springs, Summer Meeting, Automotive Equipment Association.

June 26-July 1—Atlantic City, Twenty-fifth Annual Meeting of the American Society for Testing Materials, Chalfonte-Haddon Hall Hotel.

August 28-Sept. 2—Detroit, National Safety Congress.

Sept. 18-23, 1922—Rome, Italy, Second Annual Meeting of the International Chamber of Commerce.

S. A. E. MEETINGS

Detroit, April 28, May 26.

June 20-24—White Sulphur Springs, W. Va., 1922 Summer meeting of Society of Automotive Engineers.

Orders New Dividend for Standard Parts

With Its Payment, Creditors Will Have Received Total of 25 Per Cent

CLEVELAND, March 29—Federal Judge D. C. Westenhaver to-day gave Receiver Frank A. Scott, of the Standard Parts Co., authority to pay creditors of the company a dividend of 5 per cent. About \$500,000 will be paid to creditors of the company under this order. With the current payment the receivers will have paid creditors a total of 25 per cent, and \$2,400,000 has been disbursed to holders of claims during the administration of Receiver Scott.

Scott had planned to ask the court for permission to disburse 10 per cent this time. Recent releases on contracts from customers, however, led him to cut the disbursement in half. As a result, the receiver will have \$500,000 to aid in financing plant activities of the next few months.

When plans for refinancing the H. J. Walker & Co., makers of automobile motors, were announced, it was rumored that other automotive parts and accessories makers were to be helped. It is stated that Standard Parts Co. is one on the list to receive a helping hand and that important developments which will greatly strengthen the company are likely to come within the present year.

RICHELIEU TO MOVE

ASBURY PARK, N. J., March 29—Announcement is made here that the Richelieu Motor Corp. will be transferred to Rahway, where it will be operated as a unit of the United Auto Body Corp., of which Elmer H. Mohn is president. A holding corporation of the two com-

panies has been formed, and the Richelieu car will be built for the present in the plant of the body company which will make all bodies for the automobile. The Richelieu Motor Corp. is headed by William Beckman as president and Mohn as managing director. The general sales manager is N. G. Rost, who was president of the Richelieu Motor Car Corp.

Road Accidents to Come Before Safety Meeting

BOSTON, March 27—A safety conference will be held at the State House here on April 4 and 5 under the auspices of the Massachusetts Safety Council, in co-operation with the departments of labor and industries and public safety. Wednesday afternoon will be given over to a program dealing with "Accidents on the Highway," John N. Cole, commissioner of public works, presiding. The program is as follows:

1.30—"How the Police Can Reduce Accidents," John L. Sullivan, chief of police at Pittsfield.

2.00—"Help Us Save a Hundred Lives this Year," Frank A. Goodwin, state registrar of motor vehicles.

2.25—"The Public Street as a Playground," Mrs. James D. Tillinghast.

2.50—"Educating the Jay-Walker to Become a Pedestrian," Franklin Collier, cartoonist of the Boston Herald.

3.20—"Is the Automobile or Its Driver Dangerous?" David F. Butler, assistant secretary, Automobile Mutual Liability Insurance Co.

3.50—Movies.

SELLING PAN-AMERICAN CARS

DECATUR, ILL., March 25—Edward Danner, former president of the insolvent Pan-American Motors and a receiver of the company, has been granted court permission to sell 30 cars inventoried at \$1,000 for \$630 each to the Woodbridge Co., Boston. The car was designed to sell to the trade for \$2,000.

Year Started Well for American Bosch

In Its Annual Report, However, Corporation Shows Effects of 1921 General Slump

SPRINGFIELD, MASS., March 27—American Bosch Magneto Corp. reports that because of the new starting and lighting and battery ignition equipment, forward business has increased 35 per cent over a year ago and that unfilled orders on Jan. 1, 1922, were more than \$3,500,000 as compared with \$6,300,000 Jan. 1, 1921. It states that January shipments were the best in sixteen months and that improvement is expected each month from now until summer.

The corporation felt the effects of the slump in business during the past year, for although it did not lose a single account, it states in its annual report that gross business during the year was but 25 per cent of the 1920 total. Against profits of nearly \$1,500,000 in that year the company had an operating loss of approximately \$200,000 in 1921. Including inventory adjustments, dividends and write-off for experiments and research work, there was a net reduction in profit and loss surplus of \$2,000,000.

The financial position of the company was comfortable at the end of 1921 as a result of liquidating efforts and the sale of \$2,000,000 notes. Quick assets totalled \$5,000,000, or nearly five times the rising \$1,000,000 of liabilities. Inventories were reduced to \$3,300,000, or about 25 per cent.

In his remarks to the stockholders, President A. T. Murray states that every aid is being given the Government in its investigation of the sale of the company by the alien property custodian.

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Production Program or Quotas —Which Comes First?

Description of methods employed by manufacturers to establish quotas. In current practice quotas are adjusted to a predetermined production figure. Analysis shows inherent weakness of this method and proper approach for solution of the problem.

By Norman G. Shidle.

THE annual production of each passenger car manufacturer is distributed to branches or distributors and by each branch or distributor to the various dealers within the given territory. There must be some basis for allotting cars to these distributors or branches, some method of determining how many cars shall go to each. The simplest method would be to divide the total proposed production by the number of distributors. This would give an equal number of cars to each one. The vital objections to such procedure are obvious. It becomes necessary then to determine the best possible method of making these allotments, the best possible method being that which enables the manufacturer to achieve the most efficient and least costly production and distribution.

The practical value of an accurately established quota is not sufficiently recognized in the industry at present. The methods used for establishing quota in many cases grew up out of the necessities of heavy demand during peak production times. Distributors and dealers were clamoring for cars. It was difficult to "stall them off." So certain specific quotas were laid down on one basis or another chiefly to give the sales manager some sort of reason to refuse more cars when necessary.

The fundamental reason for establishing quotas in any manufacturing business, however, is to determine as accurately as possible the probable market for the product during the given year or production period. A properly established quota will aid in the determination of the production schedule. Consequently it cannot be dependent upon a previously determined production schedule. To be of maximum value a quota should be so established that it will show with some accuracy the probable market in a given territory for the given car.

The term quota is sometimes used to mean different things. It may be built up to determine:

1. Maximum possible sales.
2. Minimum satisfactory sales.
3. Probable sales.

For the purpose of this discussion the first definition will be utilized, because it is fundamental. From it can readily be derived either of the other two, provided they are more desirable for practical use.

Uses of Quota

Too frequently the possible uses of a properly established quota are not recognized. Usually, passenger car quotas serve no purpose other than that of fur-

nishing some basis upon which to distribute a predetermined production of cars. Sometimes the quota is used to check up distributor performance to a certain extent. Quotas as now established in most cases, however, do not constitute proper standards by which to gage sales performance.

The scientifically established quota, however, has a practical financial and economy value. It can aid in determining what shall be the production for the year, which will in turn enable the manufacturer to take advantage of long range buying, to stabilize his labor force, to facilitate financial plans and to increase production and marketing stability all along the line.

It can be used, moreover, as a proper standard of performance for distributors and dealers, enabling the manufacturer to check with some real degree of accuracy the excellence or lack of ability of his distributor organization.

Before proceeding to a discussion of how such an accurate quota may be built up, it is worth while to survey the methods now in use. Nearly every plant has a different method of procedure.

In one factory quotas are established by taking the actual number of cars sold by a given distributor last year and adding to that number "as many more as the factory thinks he can handle in view of his selling ability and conditions within his territory." The number of cars to be produced by the factory, however, is determined before these quotas are established, so that the sum of the distributor's quota must arbitrarily be brought to that predetermined production total.

In another case, the distributor is expected to take a number of cars equal to a given percentage of sales of competitive makes to the total sales of the competitive group in his territory during the preceding year.

Another factory practically allows the distributor to say how many cars he will take.

Still another bases its quotas upon the number of cars taken last year by the given distributor, plus a certain number which is determined in conference with the distributor.

One company sets its production schedule and then gives to each distributor a proportion of that predetermined number based on the percentage of production absorbed by that distributor during the previous year.

One successful manufacturer likewise bases quota on the percentage of past production taken by the given distributor. Production is based upon "a number of factors compiled by the statistical department."

Another company relies very largely upon the intimate personal knowledge of the field possessed by a capable sales manager, correlated with the past performance of the distributor and the opinion of the district sales manager.

Still another method is found in basing quota upon the percentage of the given make of cars sold in the territory as related to total sales during the previous year plus a certain per cent.

A few companies use more detailed methods. One successful, conservative organization, for example, establishes distributor quota in this way: The percentage of registrations in a given territory to the total car registrations is first determined. The factory then determines the percentage of its own production absorbed by that territory during the previous year. When these percentages are about the same, as they are in many cases, the distributor is allotted that percentage of the year's production. When the two percentages do not agree, however, a compromise percentage is given, arbitrarily fixed with due regard to conditions within the territory, the number of cars that the distributor him-

self believes he can sell, road conditions and other factors.

Very elaborate market analysis work precedes the establishing of quota in one or two cases. Comprehensive and accurate data are collected concerning a large number of factors affecting sales possibilities. These data are listed, a certain weight is given to each of the factors and the factors are correlated to give the quota for the given territory.

Evaluating Present Methods

Brief analysis will show that in every case, except the last mentioned, the basis used in establishing the quota makes the quota useless so far as concerns its being an aid in determining the most economic production schedule or in acting as a standard of distributor sales performance.

This is true because the quotas are established on the basis of a predetermined production schedule, which in turn has not been based upon any very comprehensive market analysis; or they are based upon past performance as related to the given company itself. The basis of establishing quota is *relative* in almost every case, rather than *absolute*. It is not useful as a standard of performance for this reason.

In most cases only a few of the factors affecting sales are utilized in establishing the quota, which consequently becomes a necessary tool rather than a useful standard.

This condition is natural at the present stage of the automobile industry. The industry is comparatively young as a whole, while the necessity for a study of marketing problems is less than two years old. The industry has arrived at a point, however, where procedure must be based upon more fundamental factors.

Methods of Establishing Quota

In establishing accurate quota, which can be of maximum use, the problem should be approached from two angles:

1. Past performances.
2. Market analysis.

As explained in previous articles in AUTOMOTIVE INDUSTRIES, the slowness with which buying habits and human nature change makes it possible to determine with a high degree of accuracy probable trends for a year or two in advance on the basis of past performance, provided data concerning that past performance are available over a long period of time. A complete discussion of this phase of the subject is contained in AUTOMOTIVE INDUSTRIES of Nov. 17, 1921.

Thus the probable production of cars in a given price class for the coming year can be determined with a high degree of accuracy by a proper correlation of past statistics. Statistics showing the probable production by price classes for 1922 appear in the Statistical Number of AUTOMOTIVE INDUSTRIES, published Feb. 16, 1922.

In our issue of March 23 we showed how the individual company can compare its growth with that of its price class, and how it can determine its probable production for the coming year on the basis of past performance. It is unnecessary to cover these phases in detail here, but a thorough understanding of this previous material is essential to a proper reasoning through of the entire problem.

We may assume then that the Sennett company, for example, has determined its probable sales possibilities for 1922 on the basis outlined above. The figure so determined will be very nearly correct, because varying conditions throughout the country, whether favorable or unfavorable in various sections, will probably balance one another. There is not likely to be a radical change

throughout the country. There is a possibility of radical change in a small area, however, and for this reason market analysis is essential to the establishing of proper quotas.

The smaller the unit under consideration the greater the possibility of variations in the prediction made solely on the basis of past performance, because the accuracy of the prediction depends chiefly upon the occurrence and balancing of many plus and minus factors over a long period.

Therefore the third step in establishing quota is to make a thorough territorial analysis of each distributor's territory. This analysis will consider all those factors affecting sales. The method of making it will be discussed in a following article. Thus the maximum sales possibilities will be determined for the given price class in the given territory. This number is based on an *absolute*, not on a *relative*, study.

If the Sennett company has sold 5 per cent of the cars in its price class during the preceding year, it is fair for practical purposes to apply that percentage to the absolute figure determined as a result of the market analysis of an individual territory just discussed.

When this is done, the resulting figure will give the economically possible Sennett sales for 1922 in the given territory. This figure will serve

the factory as a fairly accurate standard of performance.

Human factors are not equal in all territories, however, and the quota actually set up for the distributor should be established after considering the personality and ability of the distributor, the general attitude of the public toward the car in the given territory, etc. The result of this adjustment will give the actual quota.

The sum of these actual quotas should be somewhere near the probable Sennett production figure previously determined on the basis of past performance. If there is a wide discrepancy adjustment should be made in both the production and the quota schedules.

The absolute quota can serve as a maximum performance standard in each territory, while the actual quota, which includes consideration of the human factors, can serve as the guide in establishing production.

The market analysis serves as a check on the probable production figures and vice versa. The probable production estimate cannot take into account very unusual circumstances, economic or human, which may arise in a given territory, in the management of a given company, or in the design of a given car. The market analysis can take into account these factors.

The basis of establishing quota and the various steps in the procedure may be summed up as follows:

1. *Probable* total price class production can be determined from past performance (A. I., Dec. 22, 1921).

2. Probable Sennett percentage of total price class production can be determined from past performance (A. I., March 23, 1922):

3. Distributor's absolute territorial possibilities can be determined from territorial analysis. That is, maximum price class possibility in territory can be determined on absolute basis.

4. For practical purposes, probable Sennett percentage of total price class production (No. 2) can be applied to individual territory.

5. This will give an absolute quota or economically possible Sennett sales in given

territory for 1922.

6. Actual quota can then be established by considering dealer ability, etc., in connection with absolute quota.

7. Sum of actual quotas should be somewhere near total Sennett U. S. production. If not, adjustment should be made both in production and actual quota schedules.

8. Sum of absolute quotas and separate absolute quotas serves as a standard of performance.

With this outline of procedure in mind, the next step is to consider in some detail the matter of actual market analysis and methods of correlating the factors involved.

TOO frequently the possible uses of a properly established quota are not recognized. Usually, passenger car quotas serve no purpose other than that of furnishing some basis upon which to distribute a predetermined production of cars. Sometimes the quota is used to check up distributor performance to a certain extent. Quotas as now established in most cases, however, do not constitute proper standards by which to gage sales performance.

The scientifically established quota, however, has a practical financial and economy value. It can aid in determining what shall be the production for the year, which will in turn enable the manufacturer to take advantage of long range buying, to stabilize his labor force, to facilitate financial plans and to increase production and marketing stability all along the line.

Tire Market in Yokohama, Japan

IT is estimated by Consul General Scidmore, Yokohama, in a report to the Department of Commerce, that there are between 7500 and 8000 passenger automobiles in Japan, 5500 of which are in and around Yokohama. Of this number 25 per cent is equipped with metric clincher tires, 40 per cent with inch clinchers, and 35 per cent with inch straight sides. American-made straight-side tires are freely available in the district, while Dunlop's branch factory at Kobe and the Yokohama Rubber Co. are now making this type.

While American firms are still shipping some cars to Japan, the last 18 months has shown a marked decrease. As yet no cars other than American have come in on straight sides. There are about 3000 motor trucks in the

country, of which 2200 are in and around Yokohama; 20 per cent of these trucks operate on pneumatic tires, while 80 per cent are equipped with solids. The tires manufactured by the Dunlop branch factory at Kobe, financed by English and Japanese capital, dominate the market. Most of the imported tires are of American manufacture.

Straight-side tires are very little used in Japan, for the reason that Japanese chauffeurs—there being very few owner-drivers—always run on underinflated tires—about 45 pounds for a 4-inch tire—because of the better riding conditions secured by this practice. The straight-side fabric tire soon breaks down under these conditions. Cord tires are not used because of the high price and the fact that there are no facilities for repairing them in Japan.

Powerplant in New Stutz Model Incorporates Many Changes

Lighter pistons, redesign of jackets and cylinder head and better fuel vaporizing means, among other changes, have resulted in increasing the power, speed and fuel economy. Heavier crankshaft, machined combustion chambers and stiffer cylinder block help minimize vibration.

By J. Edward Schipper

A NUMBER of changes have been made in the Stutz car, particularly in the powerplant. The latter have resulted in increased power output from the engine, lower fuel consumption, better comparative acceleration and hill climbing ability and higher maximum speeds. The changes are not radical in any sense, but include the adoption of up-to-date construction in the way of lighter pistons, better handling of the fuel, the adoption of detachable head construction and better design of the cylinder block with respect to the circulation of water, resulting in elimination of hot-spots or steam pockets.

Power output is now 50 per cent greater than before while the speed range has been increased at both ends, being five miles per hr. as compared with 10 miles per hr. at the lower end and 75 miles per hr. as compared to 60 miles per hr. at the other extreme. Cold weather performance has been improved by the adoption of a new vaporizing device. The chassis is now more quiet, due to the extensive use of anti-rattle features throughout the chassis, and the accessibility of a number of units has been notably increased as hereinafter noted.

The pistons are now considerably lighter due to decrease in length and thinner walls. The piston pin is a floating type, the pin being retained by means of a groove and spring retainer as heretofore.

The connecting rods are 14 in. in length from center to center. The crankshaft diameter has been increased by $\frac{3}{8}$ of an in. The bearing lengths of the crankshaft are now $3\frac{3}{8}$ in. at the forward main bearing, $2\frac{3}{4}$ in. at the center main bearing and $4\frac{1}{2}$ in. at the rear main bearing, while the diameter is $2\frac{1}{2}$ in. The bearings are supported in the aluminum crankcase and in addition there is a reinforcement by means of special shoulder bolts which run completely through the crankcase to the cylinder block, thus tying the entire structure together.

It is estimated by the Stutz company that the rigidity of the crankcase has been increased

by 50 per cent. This has been accomplished by extensive ribbing.

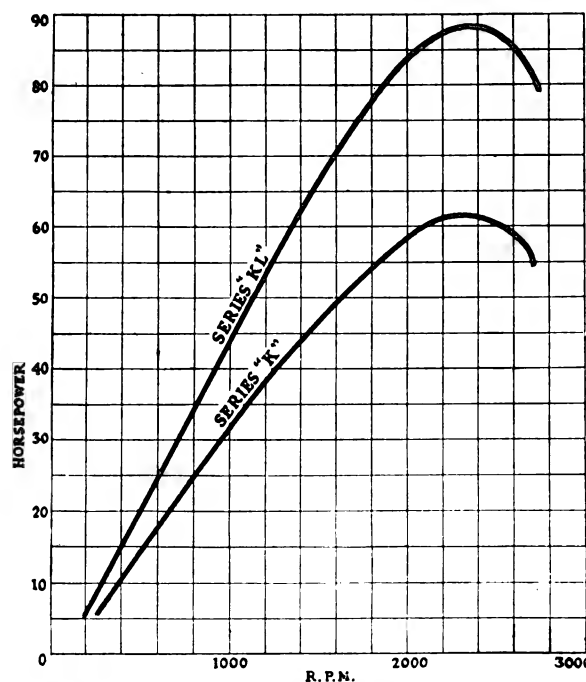
The inlet manifold is designed to create an eddy in a circular chamber. The liquid particles are broken up as they come in contact with the hot internal fins. These fins are heated by exhaust gas drawn through a tube running directly across the engine between the central cylinders. This tube is in a dead air pocket, which tends to decrease radiation from the tube itself and permit a maximum amount of heat to be carried over to the heated fins. The heated fins of the intake are placed at an elbow, so as to trap the liquid particles in the intake stream without adding much heat to the air.

New Intake System

The intake has been designed with the passages sloping away from the cylinders so that all drainage is back toward the carburetor, and the manifolding is cast in aluminum in order to take advantage of the good heat conduction properties of this metal. The intake manifold is attached to the engine by means of an aluminum flange intended to transfer heat from the engine to the intake system. About one-fourth of the exhaust is used to heat the inlet, the arrangement being such as to prevent undue back pressure on the exhaust. The exhaust pipe is carried forward toward the radiator, in order to help keep the engine heat out of the front compartment of the car.

The adoption of a detachable cylinder head has permitted the use of completely machined combustion chambers, with resultant equalization of cylinder compression and consequent decrease in vibration. The ability to secure smoother surfaces in the combustion chambers has also resulted in less adhesion of carbon particles and in more uniform cooling of the chamber walls. The cylinder head is extensively ribbed and a large number of studs are used to hold it in position and prevent gasket leakage.

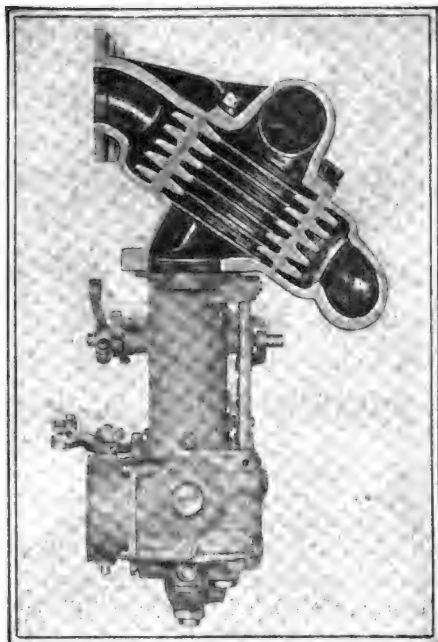
The water spaces have been designed to produce small ed-



Horsepower-speed curves showing how the new series "KL" engine compares in performance with the earlier model "K."

dies within the main body of water in order to equalize the cooling effect. The water is circulated by centrifugal pump. The fan incorporates a centrifugal feed oiling system, which carries a supply of lubricant sufficient for a season's running without replenishing. A pressure feed lubricating system distributes oil through integrally cast steel tubes, so that exposed tubing, unions and solder joints are avoided. The oil leads run to the hollow crankshaft and also the camshaft bearings from which oil is sprayed constantly upon the valve operating mechanism. The entire distribution system is lubricated by oil supplied through the hollow stud of the central idler gear of the six-gear train. Since the engine has four valves per cylinder, there are two camshafts. The idler gear has holes drilled from the hollow stud to the face of the gear. Through these holes, oil under pressure is fed directly to the meshing gear surfaces and thence supplies the entire forward gearcase.

The auxiliaries are now arranged so that the twin ignition unit is driven from the timing case, but is

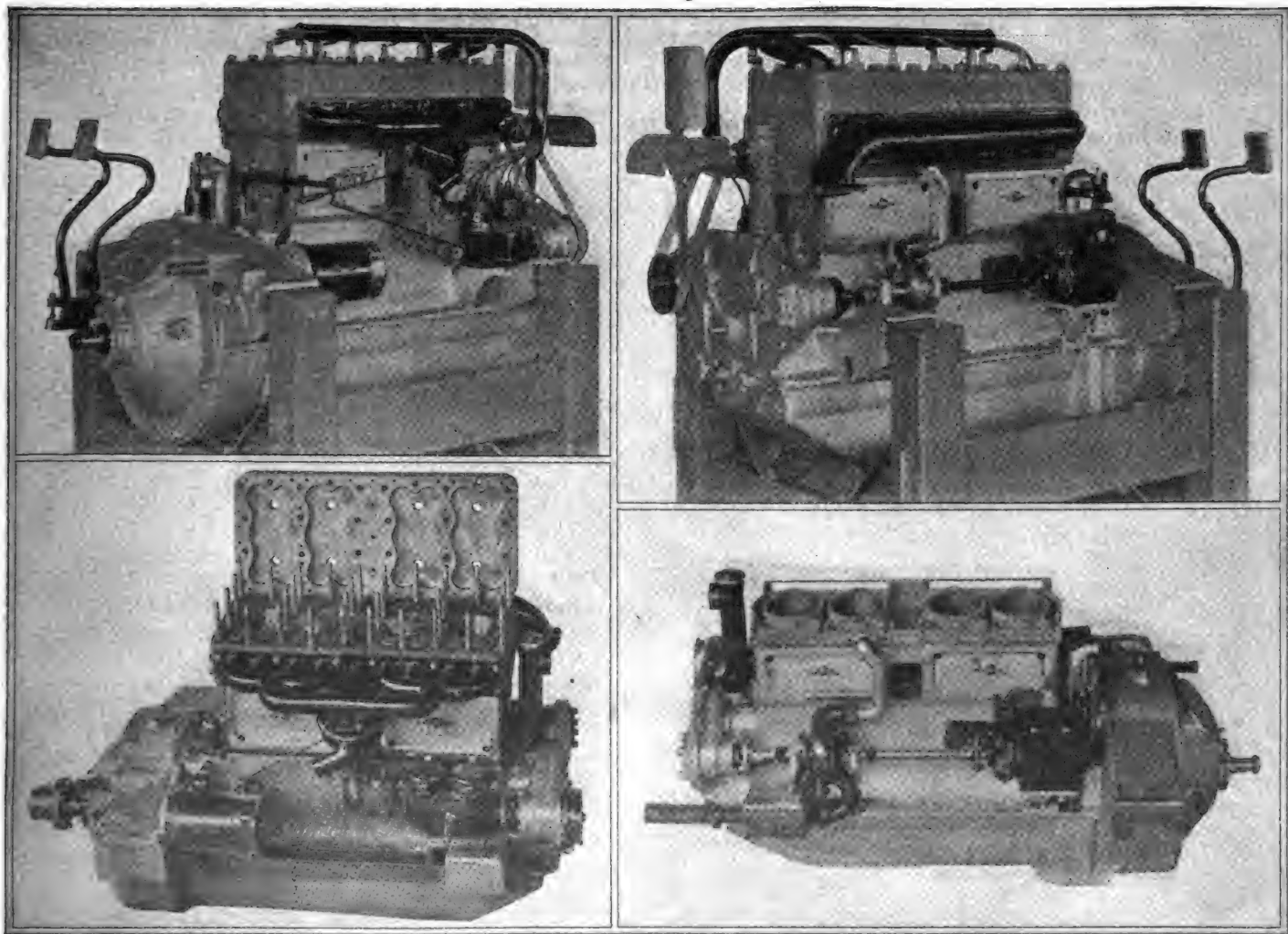


Sectional view of the exhaust heated inlet manifold used on the new Stutz.

entirely separated therefrom. The water pump and generator are on the opposite side of the engine and are now completely accessible without disturbing each other. These units are driven by auxiliary shafts provided with flexible couplings. The starting motor is also mounted individually to increase the accessibility. The ignition is the Delco dual synchronized system, with two spark plugs for each cylinder located in the center of each half of the combustion chamber.

The chassis and general construction of the Stutz car embody few changes outside of those in the powerplant. The cylinder dimensions are $4\frac{3}{8}$ by 6 in., the engine being a T-head type. The clutch is a Warner, the gearset is of Stutz manufacture, providing three forward speeds. The car is driven through a torque tube with a single universal joint. The gearset is mounted in unit with the rear axle, and in order to obtain quietness all of the con-

stant mesh gears are ground. The car weighs, with the seven-passenger touring car body, 4010 lb. The wheelbase is 130 in. and the tire size 32 by $4\frac{1}{2}$ in. all around.



Four views of the new Stutz powerplant showing type of manifolds, redesigned cylinder head, increased jacket space and several other modifications.

A New Line of Bevel and Internal Gear Axles for Trucks

Seven new axles, three of the bevel gear type, intended for light trucks, and four of the internal gear type, for either truck or bus chassis, have recently been added to Russel line. One of the bus axles is arranged for 71 in. tread and underslung springs to facilitate low body mounting.

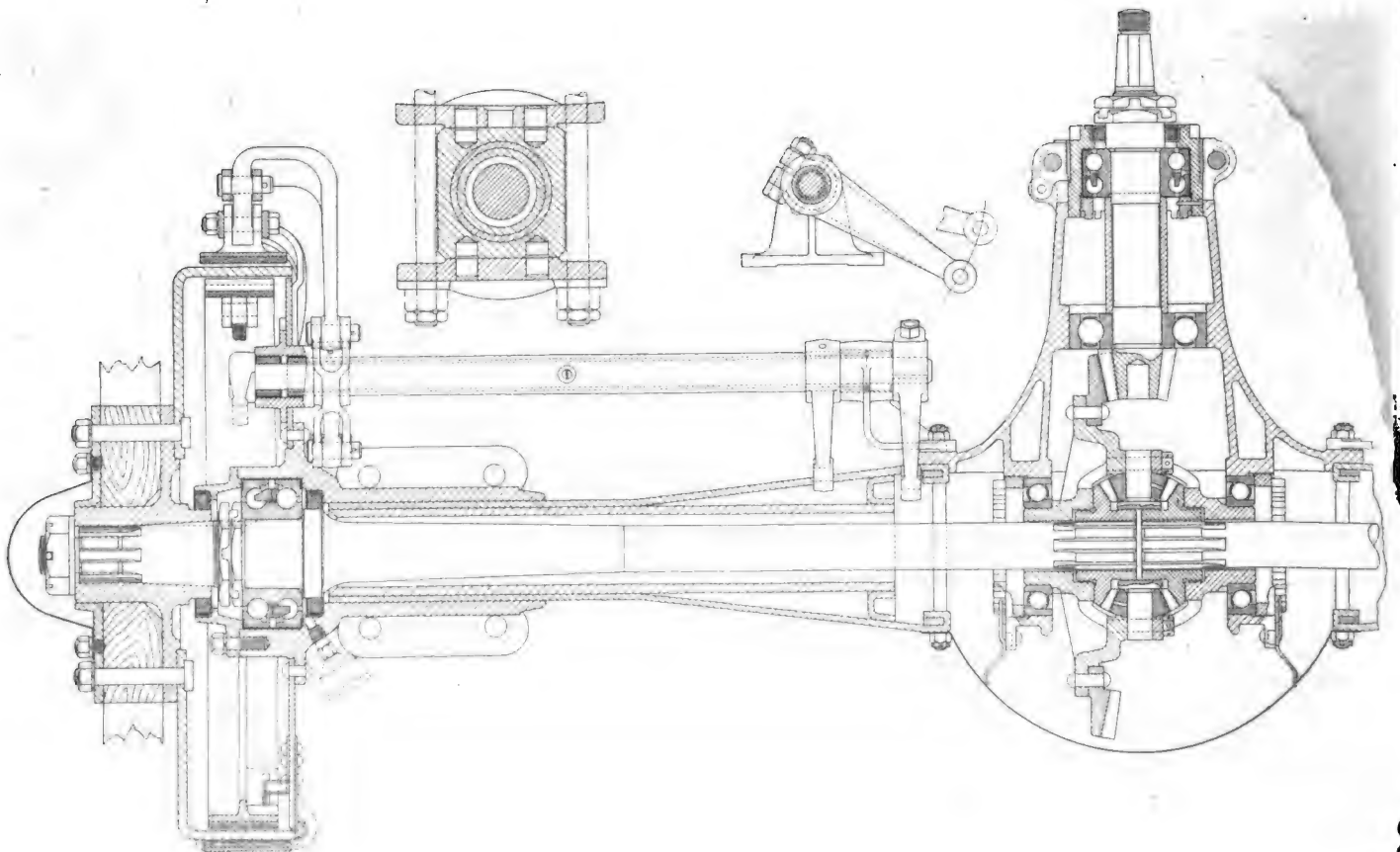
THREE new integral gear-drive axles for pneumatic tire equipped trucks have been added to the line of the Russel Motor Axle Co. The new models are very similar in design to the regular line of Russel axles described in *AUTOMOTIVE INDUSTRIES* of Nov. 10, 1921, but have larger brakes and smaller gear reductions, making them suitable for speed trucks or buses. In addition to these, three entirely new bevel gear axles for pneumatic tired trucks have also been added. These embody several features which are new practice for the Russel company. These six new models are now in production.

The three new double reduction, internal gear axles are for trucks of a nominal rating of 1, 1½ and 2 tons, and are designed for maximum loads on the spring pads of 4500, 6500 and 8000 lb., respectively. The maximum axle torque permissible is 5000 in.-lb. on the 1-ton model, 8250 in.-lb. on the 1½-ton model and 9000 in.-lb. on the 2-ton model. These axles are all designed to have both torque and drive taken through the springs.

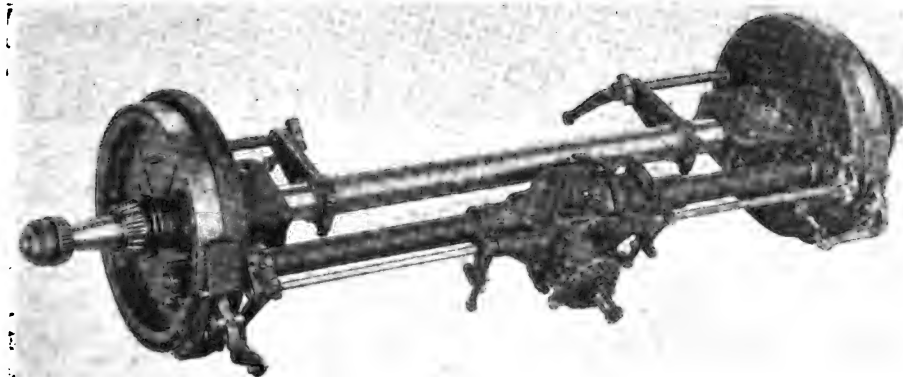
Of the bevel gear axles, the smallest one is intended for the speed truck type of vehicle having a capacity of ¾ ton, while the larger axles are intended for 1¼-ton vehicles. These axles are all of the semi-floating type with pressed steel housings reinforced by heat treated, chrome nickel steel tubes extending to within 7 in. of the center. The housing is ribbed and electrically welded over the entire length. The ribs are riveted and at the center of the housing nickel steel bolts extend through both sides to insure rigidity.

The differentials are of nickel steel with spiral bevel drive gears of coarse pitch. The axles are mounted on ball bearings and are equipped with both internal and external brakes.

Another new product of the Russel Motor Axle Co. is a motor bus axle of the internal gear type. This is of the same general design as the internal gear drive truck axles of the company. One of the differences is that the tread is wider, being 71 in. This is made necessary because of the fact that bus bodies are wide and must be



Sectional view of the new bevel gear Russel axle for light trucks



The new Russel internal gear axle intended especially for bus applications

placed low. For the same reason the springs are underslung. The load to be carried by the rear axle is equivalent to that of a 2½-ton truck. Because of the frequent stopping, it has often been found desirable to use both the internal and external brakes for service work and to install an emergency brake at the rear of the transmission. This is said to impose greater loads upon the differential and drive shafts. Bearings of increased capacity have therefore been provided for the bevel pinion, and the single row bearing adjacent to the bevel pinion is

of a larger series than that for the outer bearing.

The drive shafts are increased in diameter to provide against additional deflection because of the increased length. Taper roller bearings are used in the wheels and the recently adopted S. A. E. recommendations for wheel bearing mounting have been used.

It is gratifying to note that the axle manufacturers are sensing the growing demand for motor buses and are doing their part to meet the special requirements of that particular line of motor transport.

SPECIFICATIONS OF NEW RUSSEL AXLES

Model	Nominal Rating Without Load	Maximum Load on Spring Pads in Lbs.	Diameter of Brake Drum	Gear Ratio
Internal Gear Types:				
3000-SI	1 ton	4500	15½	6.15 to 1
4500-SI	1½ ton	5500	16½	6.6 to 1
6000-SI	2 ton	8000	18	7.4 to 1
Bevel Gear Types:				
2400-B	¾ ton	3400	15½	6.33 to 1
3000-B	1 ton	4000	16½	5.28 to 1
3600-B	1¼ ton	4600	18	6.33 to 1
				5.28 to 1

A Large Double-Crank Toggle Press

DURING the past several years rapid strides have been made in the use of steel stampings for all classes of light machinery, and particularly in the automobile industry. The use of stampings has been extended to lines of industry dealing with very large units, and to keep pace with this progress the manufacturers or builders of power presses have put out machines of sizes and capacities that a few years ago were not dreamed of.

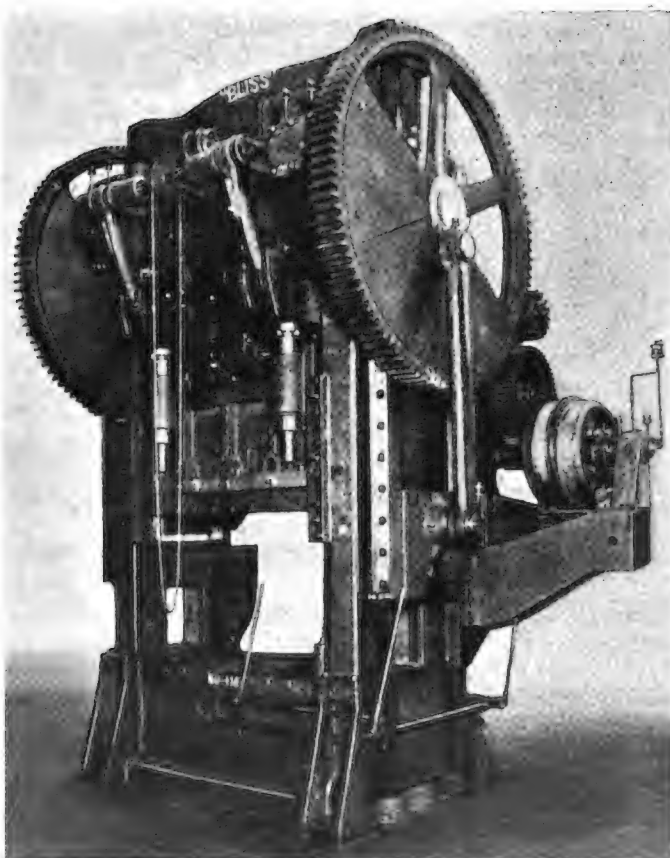
The accompanying illustration shows a double crank toggle drawing press recently completed by the E. W. Bliss Co. It is of tie-rod construction, twin-driven and triple geared, and has a gear ratio of 85 to 1. The gears are all of steel and have machine-cut teeth.

Power is transmitted from the main drive gears to the outside slide or blankholder through a series of toggles, and a dwell of 120 deg. is obtained. The number of toggles and connections used is said to be the least possible for efficient results. In wide presses, to avoid torsional strain, the power is transmitted to the outside slide from both ends of the press. This method is also followed out in connection with the crankshaft which operates the inner slide, this being twin-driven by means of a gear on each end.

The small number of connections or links used in transmitting power to the outer slide makes for economy in power consumption, and to minimize wear in the connection pins they are hardened and ground. Adjustment of the inner slide or plunger is made by a 15-hp. motor mounted on the front of the crown. The machine itself is driven by a 100-hp. motor and operated by a powerful hand-actuated friction clutch of the double-grip type, by means of which the operator has the moving parts at all times under control.

The photograph gives an idea of the huge size of the machine here described, some of the principal dimensions of which are as follows: Distance from bed to the inner slide with the stroke down and the adjustment up, 59 in.; distance from the bed to the outer slide with the stroke

down and the adjustment up, 56 in.; stroke of inner slide, 28 in.; stroke of outer slide, 20 in.; area of bed, 60 by 116 in.; area of face of blankholder, 60 by 102 in.; area of face of plunger, 36 by 86 in.; weight, about 600,000 lb.



Bliss double-crank toggle press

Experience Gained as a Result of Road Tests of Railcars

Information as to limitations and performance in actual service can be gained from such tests especially when the simple apparatus here described is employed. Data regarding special conditions to be met in railroad service and some useful comparisons with steam propelled equipment are given.

By Donald A. Hampson

RAILCARS are subjected to road tests for much the same reasons that other automotive vehicles are, and for other reasons peculiar to railroad conditions. These reasons may be summed up as follows:

- 1—To note the action and fit of wheels on the rails.
- 2—To locate any weakness or maladjustment in the car structure or power line.
- 3—Speed test.
- 4—To run in various working parts.
- 5—To determine the power as a self-propelled unit and as a motor car.
- 6—To furnish ocular proof of "roadability."
- 7—Braking tests.
- 8—To compare actual performance with theoretical data.

No. 1 includes a variety of details. The gage of an automobile is relatively unimportant—the "gage" of railroad wheels is of vital importance. Fig. 1 shows the elements of wheel and rail mating; the former is the standard adopted by the Master Car Builders' Association and the latter is the Civil Engineers' shape of rail head and spacing, which is the only "standard gage" of track in use by steam and electric roads. It will be noted that there is no shoulder to shoulder contact between wheel and rail simply rolling contact between the wheel on the concave portion of the flange with a corner of the rail rounded to a smaller radius.

The track gage is measured between vertical faces. On

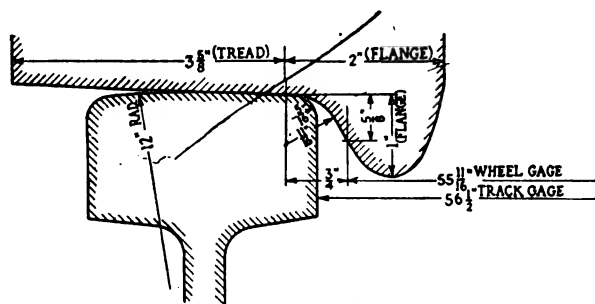


Fig. 1—Detail of rail and wheel flange, showing where gage is measured

the wheels, a gaging point has been selected arbitrarily about half way up on the flange and the wheels are so placed on the axles that these points on two wheels are a fixed distance apart. Shop men and car inspectors are supplied with gages made by Pratt & Whitney and other tool makers; by this means, the contour can be held within close limits. When wheels are new, they are only free enough (on track that is spiked up to gage) to roll easily; as they wear, the flange takes on the curve of the rail head, allowing greater freedom, until the wear amounts to about 1/4 in. at the gage point when, according to "Rule

74," the wheel is condemned and taken from service.

Now, wheel gage is not such a serious matter within the M.C.B. limits, but taken in conjunction with worn rails, track out of gage, rotted ties, the allowance made on curves and special track work for the long rigid wheelbase of locomotives, it merits all the attention given it. If the tread of a car wheel (see Fig. 1 for the difference in application of the term) is narrow or broken out and the flange on the opposite wheel is badly worn, the wheel on the inside of the curve can run off and drop between the rails. A wheel hub out of true, a slightly bent axle, bolts unevenly drawn up, a wheel inaccurately machined—any of these causes would be passed over as unimportant on a motor truck (probably laid to the rubber tire), but might result in derailing the same truck if placed on the railroad.

Wheel Tests on Track

Hence, it is very desirable to test newly assembled wheels on a track that is right. If this track happens to be the road that is to use the car, a trip should be made over it regardless of previous tests and, in so doing, particular attention paid to those sections which are known to be badly out of gage. Spring frogs should be given careful attention if there are any that the motor car has to open; a frog may have its spring set up so tight that the relatively light weight of a motor car will not let the flange open it, and derailing will result.

Wheels for steam roads have a wide tread which projects outside the rail when both are in correct relation. If this same wheel were run over street car tracks, the projecting tread would soon ruin the bricks of pavement laid close up to it. For this reason, and because the confined location helps keep the track to gage, most street car wheels are made with a tread of only 2 1/2 in., with interurbans an average of 3 in. Street car flanges of the A.E.R.A. standard are approximately one-fourth less in size than the one shown by Fig. 1. The openings in the grooved rails can therefore be less, making a smoother street for other vehicles, and the tendency to fill up with street dirt is not so serious.

It is necessary to know the details of track structure when supplying the wheels for a railcar. It was doubted in one case we have in mind whether a gasoline railcar could make a certain hairpin curve of but 36 ft. radius. This curve had a rise of 10 ft. between tangents and, with the two grooved rails, the wheel friction is so high that electric cars draw an average of 200 amperes in passing the curve. The motor railcar had flanged steel rims with proper size of flange for the rail. In spite of the fact that the curve was greased, the car made it without trouble; its construction avoided entirely the cause of the enormous power consumption with electric cars and their

fixed axles—the differential at the rear and the swivelling front wheels enable the car to pass such a curve with none of the wheel slipping so productive of power loss and stresses.

A few hours or a few days spent in test running of different kinds is time well spent. Every piece of machinery "finds" itself after a limited amount of usage in the field of its application and then requires minor adjustments, taking up of nuts, refitting, etc. Moreover, dynamometer or similar tests do not reflect the true conditions until the first newness is off and lubricants begin to act to best advantage. In the case of a railcar, it is far easier to give it these attentions before the body is on than afterward, when other fittings are in the way of both action and observation. Then, there is the matter of finish. The splatterings of oil and grease on a bright new body coat leave unerasable marks when mixed with the dust from the roadbed.

Maintaining Scheduled Speed

Speed is a detail that may be foretold with accuracy. That is, mere speed in miles per hour. But ability to maintain a schedule is quite another matter. Whether a car can be handled, with ordinary help, at terminals in the lay-over time allotted; whether it can accelerate at so many miles per hour per second, without slipping the wheels when the load is light and has sufficient power for this same acceleration when the car is overloaded; whether the brakes are so designed as to permit a high rate of deceleration; whether due regard for other traffic shatters a time card when the machine is driven by a man of average skill and temperament—these are points that must be considered in connection with speed. The best time for a conclusive speed test is on a damp day—rails are then greasy, carburetion may be slightly affected, other traffic need greater attention—a run on schedule time on such a day is the best evidence of a car's performance under adverse conditions—and a run with chassis only should include several seconds extra time at each stop to allow for the slowness of passengers bundled up and with dripping umbrellas.

Speedometer readings are an aid to the driver, once he has learned the road and knows what time he must maintain between stops to make his schedule. By a glance, he knows whether it is necessary to speed up a few miles per hour to make up for a lost minute or two.

Correct Speedometer Drive

In many cases, a change from rubber tires to metal wheels involves also a change in diameter; sometimes there is made a change in gear ratio as well. In such cases, the gears driving the speedometer cable must be changed. The best arrangement for speedometer drive on railcars is one off the transmission shaft.

Running in is a part of the general road test, as mentioned above. It has another significance from the railroad standpoint, namely, smoothing up the rail surface of the wheels. It is customary in railroad car practice to send passenger coaches out on a slow freight, for a fifty-mile run, after new wheels and axles have been put in before putting them in high speed service, so the wheels will become polished and lose that disagreeable noise peculiar to them without it.

Fig. 2 shows a 1922 Model 30 Gramm-Pioneer 3-ton railcar chassis as taken out for road tests. The weight of the car as illustrated is 6300 lb., of which 2900 is at the base of the rear wheels. The body for this car, with maximum seated load, totals 7800 lb., most of which comes on the rear wheels—this gives a high factor of adhesion for the car in service, which could not well be realized during the tests, though 1100 lb. of old rails were piled over the rear axle to increase traction at the time.

Drivers are of iron with chilled treads, selected because of their economy and wearing qualities and in preference to steel whose slightly greater adhesion was of little moment with an engine of the size employed. Stock cab, fenders, muffler, and step later give way to body, special wheel guards, heater pipes, step inside body, etc. Fire extinguisher, bell, sanders, lights, and couplers, remain to be added.

This Gramm model has a $4\frac{1}{4} \times 5\frac{1}{2}$ engine. The gearset is four speed, with individual clutches. Wheels are 33 in.



Fig. 2—The Gramm-Pioneer railcar chassis used in one of the tests described

in diameter and the worm drive has a reduction of $4\frac{1}{2}$ to 1, which is the overall high speed ratio, with a low ratio of 21.3 to 1. Conservatively figured, the tractive force delivered at the circumference of the drivers is 282 lb. on high, increasing to 1130 lb. on low. Taking a value of 25 lb. per ton as the starting resistance of the (new) truck on the rails, its total resistance with two men is practically 100 lb., which must be subtracted from the 1130 lb. above in calculating the amount of pay load which can be hauled on or behind the chassis. The weight at the drivers is 4000 lb. The coefficient of friction between iron wheels and steel rails may be taken as .24 when dry and clean, which gives us a theoretical available tractive effort of 960 lb., and as this is less than the 1130 lb. delivered by the engine, the latter can slip the wheels.

Drawbar Pull and Tractive Effort

In locomotive practice, "drawbar pull" and "tractive force" (or "tractive effort") are widely different terms, tractive force being the sum of the available drawbar pull and the resistance of locomotive and tender. For instance, 57,200 lb. is the rated tractive force of the newest Mountain type passenger locomotives on the Norfolk & Western; these are in service on a 150 mile run out of Roanoke with grades as high as 1.32 per cent and haul a 577 ton train at an average speed of 40 miles per hour. The locomotives weigh 257 tons, which at that speed offers a resistance of 2570 lb. on a level tangent as against a resistance of 4000 lb. for the train under the same conditions. The sum of 2570 and 4000 represents the tractive effort expended at the time and of this about two-fifths was expended in moving the locomotive and tender while the remainder (4000 lb.) is the drawbar pull. A power unit offers more resistance than a pulled unit of the same weight.

The railcar was first attached to a 26-ton box car. Cold and in average condition, such a car has a starting resistance of 650 lb. This box car was started easily and without perceptible slip of the driving wheels—its resistance plus that of the motor car is considerably less than the available tractive effort. Once under motion, the speed was brought up to that of the next gear and the clutch shifted.

The next heavier car in the railroad yards, convenient at the time, was a steel gondola stenciled "Wt. 72,000 lb."

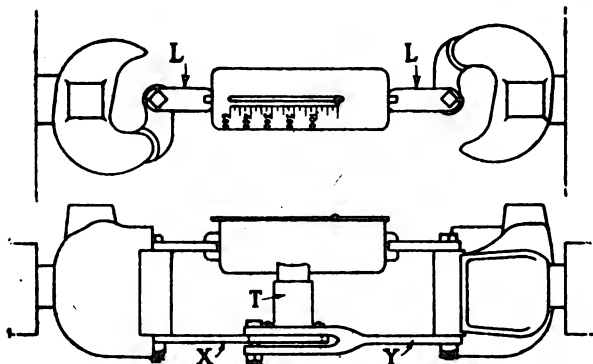


Fig. 3—Sketch showing simple form of drawbar dynamometer which can be used to advantage in road tests of railcars

The resistance of this plus that of the Gramm itself is just 1000 lb. Backing the railcar up to the gondola, it was found that the wheels slipped and would not start the latter. But when the rails were sanded, it was possible to move the gondola and to reach a speed at which a gear shift could be made in a distance of 100 feet. A poor driver could not have attained this result, for he would have raced his engine, thus spinning the wheels and lowering their adhesion greatly—a good driver, on the other hand, was able to show in practice 100 per cent of the theoretical power, or nearly that, as judged from the tests.

Test Device for Railcars

Fig. 3 shows a device used to check the resistance on one railcar when hauled by another or the drawbar pull exerted by the forward car. It is so arranged that an observer can occupy a position of safety throughout the run and take readings from the start up to the maximum speed of the power unit. Shoulder bolts were made up to pass through the hole in the coupler knuckles and two pairs of links fitted to these, the links *L, L* being attached to a spring balance, and links *X* and *Y* providing the safety feature. Link *X* is slotted so that a bolt through the fork end of *Y* will strike the end of the slot in either direction before the upper links can be drawn out so far or pushed together enough to damage the scale.

A piece of pipe *T* is attached to the upper face of the link *Y* and inside it is a spring plunger with a concave top face partially surrounding the spring balance case and supporting the latter so that its weight does not cause binding and possible error from that source. The advantages of such a test unit for motor cars are at once apparent. With fuel carefully gaged, it is possible to determine the consumption with light loads and heavy, over divisions with numerous grades and curves, to check theory with practice, and to plot performance curves of direct value. The decreased resistance of a car after it has been in service a couple of months may be noted and this, compared with fuel consumption, will show whether

or not the engine is showing an economy in proportion and when a tuning up is necessary to maintain engine efficiency. A device of this kind does not interfere with train operation and it forms an inexpensive, quite reliable means of collecting data for those who are removed from or cannot afford dynamometer tests. It will show, among other things, that a country which "looks level" is neither flat nor level, but slopes enough to create a track grade of one-half per cent or more.

It is not suggested that any rail motor cars be used for moving freight cars—such action ought to be vigorously discouraged—but the freight cars serve as a convenient means to an end.

Railcars ride smoothly, as quietly as any passenger coach on a branch line, show an acceleration equaled only by an electric car, and dispel entirely the ideas formed by riding on a locomotive or motor truck or a bus.

Braking Tests

Braking can be demonstrated and tested as a portion of road tests. Without a weight equal to the full load or the body load on the rear, the front wheel brakes assume the greater share of the work during a test. In fact, to insure 100 per cent braking on a railcar, commercially at least, front wheel brakes are absolutely necessary. The average running time is increased by good brakes and high braking pressures. Air brakes supply this need more thoroughly than manually operated brakes. An advantage of the air brake is that it is not subject to fatigue, as is a driver; further, it is possible to more easily effect a gradual release of brake pressure as speed decreases and the coefficient of friction rises, maintaining throughout the most effective pressure which is at a point just before the wheels begin to skid.

In conclusion, there are a few suggestions to be made that will assist in daily service, which is the real road test of the road car. Truck and automotive units are not available out of stock to give a high enough road speed except by the use of large wheels. Large wheels increase the floor height and raise the center of gravity. Wider use of rail cars will come when there is available an axle that is geared higher, is more rugged and simple, and comes minus the differential.

Service

More and better service will be realized from rail cars when a separate department, though small, is created for their maintenance. To expect a freight car repairman or a mechanic used to rough work on thousand pound locomotive parts to intelligently cope with adjustments and repairs on the railcar is unreasonable, to say the least. The truth of this is found in air brake work which more nearly approaches automotive work in size and accuracy than any other work done in railroad shops. Such work is handled by separate groups of workmen who make a specialty of this and are provided with all necessary facilities for repairs and testing, housed in separate departments under highly trained specialists.

Resistance of Battery Separators

MEASUREMENTS of separator resistance on a number of samples of different kinds of wood which were submitted by the manufacturers have been completed by the Bureau of Standards. A comparison of these results with those obtained on similar samples last May shows excellent agreement and proves that the method for measuring the resistance is reliable. The soft woods, such as poplar and basswood, have the lowest resistance; cedar and cypress, on the other hand, have considerably higher resistance, but are known to have

better lasting qualities when used in storage batteries.

In determining the durability of the separators in sulphuric acid solutions of different densities, a number of samples have been cut to a specified size and immersed in an acid solution of known concentration. One set is being kept at room temperature and a similar set at 45 deg. C. At the end of periods of one month, three months and six months samples will be withdrawn from the solution to determine the decrease in tensile strength of the separator material.

Design and Functioning of Laminated Automobile Suspension Springs

Part I

The character of laminated springs as well as their theoretical and actual functioning is dealt with herein. The author offers suggestions for improvement in design and urges a more serious consideration of the subject.

By A. A. Remington*

THE actual invention of laminated springs is shrouded in mystery. They were undoubtedly first used on the road vehicles probably invented for them, as at the date of their invention, about the year 1750, no other types of vehicles existed. Between the years 1750 and 1790 laminated vehicle suspension springs came into general usage, and we find that in the year 1768 Dr. R. L. Edgeworth was awarded three gold medals by the Society of English Arts and Manufactures for demonstrating the advantages of sprung vehicles, and in the well known work by William Felton entitled "A Treatise on Carriages," published in 1790, it states that an industry for the manufacture of laminated carriage springs had at that date been started.

The modern conception of elasticity, with particular reference to springs, appears to have begun with Robert Hooke about 1678, and he was followed closely by Mariotte, who in 1686 originated the term "fiber stress." In 1744 James Jurin published a paper entitled "On the Action of Springs"; but the most important investigator in connection with laminated springs was a Frenchman, by name E. Phillips, whose researches were published in 1852 in the *Annales des Mines*. Phillips applied the theory of elasticity to the particular case of the laminated spring, and was the first to propound the rhomboidal plan for a beam of uniform thickness and uniform stress, and

given the independent and serious treatment which it deserves.

A semi-elliptic spring is a special case of a beam. Assuming it to be loaded at the center and supported at the ends, and that it is flat when loaded, the bending moment is $WL/4$. The condition of maximum economy is fulfilled when all the material is uniformly stressed, which in a beam occurs when the resisting moment is equal to the bending moment on all sections. Phillips showed that this condition is complied with for a beam of uniform thickness when the plan is a rhomboid, and a beam of this form, if cambered to a circular curvature, will lie flat when loaded as shown at A, Fig. 1, whereas a similarly cambered rectangular section beam will take the form shown at B, and will not lie flat from any camber. The beam shown at B contains twice the material of beam A, and for a given deflection the maximum change of curvature is greater, and therefore the greatest stress is higher.

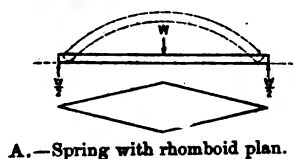
The spring shown at A, Fig. 1, although flat and touching its support all along, will only bear on it at its tips, and the pressure will be $W/2$ at each end.

The resisting moment Z of a beam is $\frac{1}{2}I$, and for a rectangular beam under static conditions this value is $bt^3/6$, the formula being derived from the stress triangles as shown at A, Fig. 2, from which it is seen that—

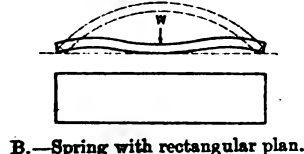
$$\frac{1}{2} I = \frac{bt}{2} \times \frac{2}{3} t \times \frac{1}{2} = \frac{bt^3}{6}$$

As applied to beams of small flexure, say a maximum of 1 to 400, this formula is found to be sufficiently accurate. For spring plates, however, which in extreme cases may deflect as much as 1 to 5, and rectangular beams having considerable flexure, it is extremely doubtful if it holds good without modification, as the stress is far from uniform throughout the section, and consequently the beam does not behave as one composed of two triangles, but more of the section becomes effective and modifies the conception to a form approximating that shown at B, Fig. 2, and with it the formula expressing the stress, which in extreme cases may become $bt/4$.

Tests made on spring blades show that the stress cannot be so high as the results given by the unmodified beam formula, as single blades will, without taking a permanent set, carry loads representing a fiber stress as calculated by this formula approximating their maximum tensile strength. For example, the standard test provided for carbon steel railway springs** necessitates a theoretical stress of 68 tons per sq. in., and allows a margin before permanent set takes place in a properly tempered test piece of about 15 per cent.



A.—Spring with rhomboid plan.

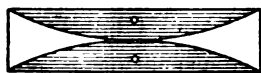


B.—Spring with rectangular plan.

FIG. 1



A.—Beam of low flexure.
 $Z = \frac{bt}{2} \times \frac{2}{3} t \times \frac{1}{2} = \frac{bt^3}{6}$



B.—Beam of high flexure.
 $Z = \frac{1}{2} (\text{area} \times \text{moment}) = \frac{bt^3}{4}$

FIG. 2.

to demonstrate the sub-division of the rhomboid into a series of laminations to form a laminated spring.

The data found in all our modern pocket-books, and most of the scanty treatment of the subject in more pretentious text-books, are based on Phillips' work, slightly amplified by later writers, and it is time the subject was

*Paper presented to the Institution of Automobile Engineers. Slightly condensed.

**B. E. S. A. report No. 24, part 3, pp. 6 and 7.

Phillips showed that a rhomboidal beam can be cut longitudinally into any number of pieces superimposed as shown in Fig. 3 to form a laminated spring without effect on its action as a beam or spring. A laminated spring so formed is uniformly stressed throughout, and if made with circular curvature, the curvature under deflection will, due to the uniformity of stress on all sections, remain circular but of increasing radius until pressed flat, the blades only touching each other at the tips. This statement requires a little modification, as on account of the thickness the radius at the back is greater than that at the front by the thickness of the blade, so that when "nipped" up there is, at the free position, a small positive stress in the shorter plates and a small negative stress in the longer plates, but this effect diminishes with loading until, when flat, all the blades are stressed uniformly.

The behavior of a spring as a component part of a suspension depends on a number of external factors, all of which affect the smoothness of riding of the vehicle. The ideal to be aimed at is that while the wheels will follow the inaccuracies in their tracks on the road, and maintain uniform adhesion, the sprung portions of the vehicles will float along without vertical movement, rolling or pitching. This ideal is not attained, and in practice all three movements occur; it is therefore the object of the designer so to proportion the parts that road irregularities will cause as little disturbance as possible, and to reduce the more objectionable disturbances to the greatest extent possible, even at the expense of some increase in the less objectionable ones. To avoid temporary separation between the vehicle and the load (in the case of a passenger vehicle, the passengers involuntarily leaving their seats), it is necessary to insure that the vertical acceleration of that portion of the vehicle carrying the load shall never exceed that due to gravity.

Vertical Acceleration

The vertical acceleration depends on the periodicity and the amplitude of the suspension. The former is a function of the design of the spring or springs, and the latter is governed by the magnitude of the external forces imposed on the suspension, and principally arises from the wheels passing over obstructions. The amplitude is therefore in reality outside the designer's control, but he can assess it for the conditions likely to be encountered.

Amplitude in itself is not an objectionable feature provided that the maximum acceleration is less than that due to gravity, and in practice it is found that this value is seldom exceeded if the periodicity of the suspension is 90 complete oscillations per minute, represented by an initial static deflection of the mass of 4.4 in., on a spring with a "straight line" load deflection curve.

Periodicities lower than this are preferable from the point of view of period of oscillation *per se*, and as regards the resulting increased amplitude, not objectionable except for the difficulties introduced in connection with mud-guard clearance, ground clearance, and universal joint action. Too low a periodicity has, however, one very objectionable and little expected effect, namely, the reduction of the continuity of the adhesion between the wheel and the road. The adhesion that will cause slip or spin, either intermittent or continuous, for a given road wheel torque is determined, on all but a perfect road surface, by the periodicity of the wheels and the axle as between the elastic tire and the spring, and a lower suspension period reduces the wheel period, lessens the adhesion and consequently conduces to wheel slip.

Nomenclature

The existing nomenclature as applied to laminated springs is not very definite and varies in different shops

and districts. The nomenclature and symbols preferred by the author and adopted for the purpose of this paper are shown in Fig. 4.

The word "camber" is commonly used in several ways, but the author confines its use to reference to the actual curve of a blade, and prefers to use the word "height" to define the vertical distance from the bed to the center of the eye of a complete spring.

The term "flat" is frequently used and varies in definition. The author understands that when a spring is loaded till it is "flat" the flatness refers to the main blade, and that a spring when flat is as shown at A, Fig. 5, not as at B.

The usual beam formulæ put in suitable form for making calculations on laminated springs, together with some convenient tables, are given in Appendix I.

Determination of Stress from Strain in Bending

Strain is the distortion, and the ratio of stress to strain within the elastic limit, where strain is assumed to be proportional to stress, is termed the "modulus of elasticity," or Young's Modulus. For steel in tension this is found to be an approximately constant quantity whatever the intensity of the load or the quality, composition or state of the steel, and can be assumed to be 27,500,000 in lb.-in. units. A representative stress/strain diagram to an exaggerated scale is shown at A in Fig. 6.

When a plate is bent, the outer side is stretched and the inner side contracted, one line within the material, the "neutral axis," being neither stretched nor contracted; this, for the present purpose, may be considered to lie at the mid-thickness of the plate.

Let us assume that a plate of rectangular section of uniform width and uniform thickness is to be bent to a complete circle as shown at B, Fig. 6. The dotted circle is the neutral axis and has length $2\pi r$. The outside will have length $2\pi r + \pi t$, and similarly the inside will have length $2\pi r - \pi t$. The total extension (elastic extension assumed) or strain of the metal i will depend on the thickness, length and radius, or camber, of the plate, and, by using an approximation, substituting the length of the half-chord for the arc as shown at C, Fig. 6, will be found to be $4dt/l$, the stress f to be Ei/l , or by substitution $(E \times 4dt)/l$.

This applies to all beams having uniform bending and within the limits of the approximation is correct for perfectly elastic material uniformly stressed; it therefore holds good for a beam of uniform thickness with rhomboidal plan loaded at the center, as well as for the usual case of a beam of uniform thickness and width uniformly loaded, but is not applicable to a rectangular section beam loaded at the center, or any irregularly strained beam, for example, a laminated spring that is not in conformity with the "rhombus" law.

Weight and Reliability

The suspension is one of the heaviest sections of a chassis, and a set of suspension springs frequently totals 200 lb. in a chassis weighing between 2250 and 2750 lb. It is greatly to the designer's interest, therefore, to reduce the weight of the springs, if it can be done without reducing their effectiveness or reliability. The effectiveness depends primarily on the rate of deflection and the reliability on the maximum stress at the most highly stressed point.

The reliability of the spring must not be judged by the amount of metal in it, as this may only be a measure of its inefficiency, and if the stress distribution is irregular the surplus metal may actually reduce the reliability by causing local overstressing, which would not occur if the strain were more evenly distributed.

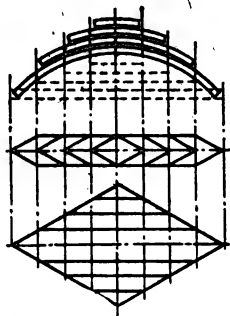
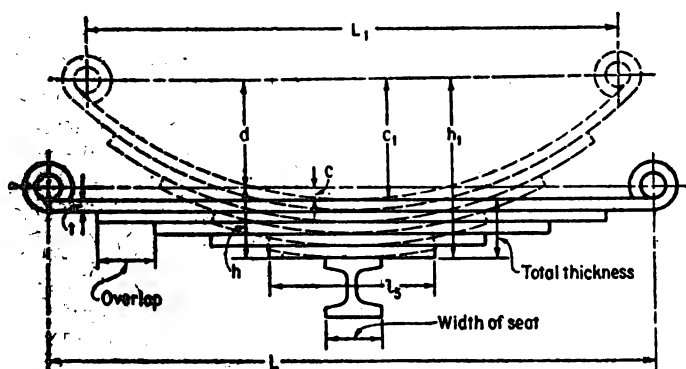


FIG. 3.—Laminated spring with rhomboidal plan.



Length (loaded)	L	Breadth	b
Thickness of blade	t	Load	W
Length (light)	L_1	Max. safe load	W_s
Camber light	c_1	Modulus of elasticity	E
Camber loaded	c	Stress	f
Height light	h_1	No. of oscillations per min.	P
Height loaded	h	Time of one oscillation	S
Length flat	l	Rate of deflection	D
Deflection	d	Total thickness	T
Overlap	o	Weight of Spring	w
	$d = c_1 - c = h_1 - h$	Gravity 32.2	g

Blades are designated by number, the main blade being No. 1. Thus in the 5-blade spring shown, the length of the shortest blade is l_5 .

FIG. 4.

The index to the weight of a spring and the best basis for comparison of weights is the volume of the primary rhombus, which is—

$$(lbnt)/2$$

or, as $nt = T$, if based on the full thickness of the spring—

$$(lbT)/2$$

To obtain the actual weight of the complete spring, this must be multiplied by the weight of unit volume and additions made for the eyes and clips and for the excess over rhombus weight, as the main blade is full width throughout, and also if the second blade is full length.

For springs as ordinarily made, including allowance for clips and bushes and one full length blade in addition to the eye blade, the total finished weight varies between 1.45 and 1.55 of the rhombus weight.

Strength, Stiffness and Resilience

The strength of a spring refers to the safe load it will carry, while the stiffness refers to the amount it deflects from the free position either at a specified load or at the maximum permissible load. Resilience refers to the work stored in a deflected spring.

Rankine shows (1) that the strengths of similar beams are directly as their widths and the square of their depths and inversely as their lengths; (2) that the deflections of similar beams under equal loads are as the cubes of their lengths and inversely as their breadths and the cubes of their depths; (3) that the resilience of a beam is half

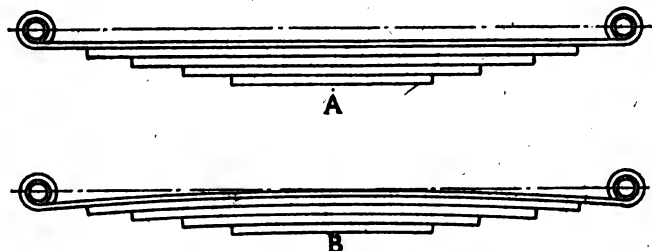
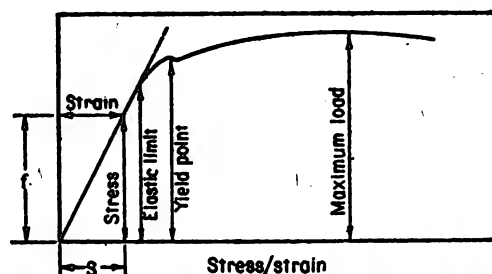
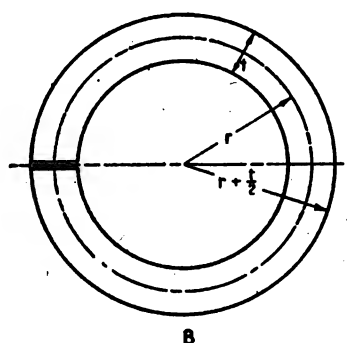


FIG. 5.—Definition of a "flat" spring.

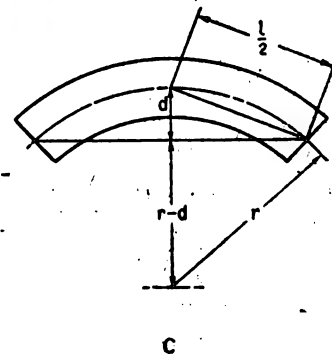


Modulus of elasticity $E = f/s$ and is equivalent to the stress that would produce unity extension (i.e., double the original length of the specimen) if strain remained proportional to stress.

A



B



C

FIG. 6.

the product of the deflection and the static load producing that deflection.

The formulæ expressing the above statements are:

$$\text{Strength} \dots \dots f = [(WL)/(bt^3)] \times C$$

$$\text{Deflection} \dots \dots d = [(WL^3)/(Ebt^3)] \times C$$

$$\text{Resilience} \dots \dots i = (dW)/2$$

C is a constant which varies for the section of beam and the method of support.

Ratio Between Static and Maximum Stress

The deflection of a spring under an imposed static load is easily predetermined or measured, but the amount which the spring is going to deflect beyond this point in service depends on a number of external, indeterminate factors. Apart from possible artificial mechanical limits, the limitation is the amount of discomfort that will be tolerated by the "load" under adverse conditions.

The author has made tests on the road with a device for recording spring deflection, and finds that with normal suspension it is necessary to provide, both as regards clearance and stress considerations, for total deflection on the rear springs of from one and three-quarters to twice the static deflection, and on the front springs of from two and a half to three times the static deflection. Since the front springs are stiffer than the rear springs, the deflections will be of less magnitude, and consequently the maximum deflection will usually be less than the maximum rear deflection.

TABLE I

TABLE OF SPRING DEFLECTIONS UNDER VARYING CONDITIONS
Car—4-seater, nominal 20 hp. with 4 passengers.
Weight—Front, 16 cwt.; rear, 20 cwt.

	Front Suspension			Rear Suspension		
	Deflec- tion in.	Relative Value	Dis- place- ment in.	Deflec- tion in.	Relative Value	Dis- place- ment in.
Static	1.2	1.0	0	4.7	1.0	0
At 20 m.p.h. on smooth road.	1.7	1.4	0.5	6.1	1.3	1.4
At 20 m.p.h. on rough road..	2.4	1.8	1.2	7.0	1.5	2.3
Driven off a 4½-in. curb at 30 m.p.h..	3.2	2.8	2.0	9.4*	2.0	4.7

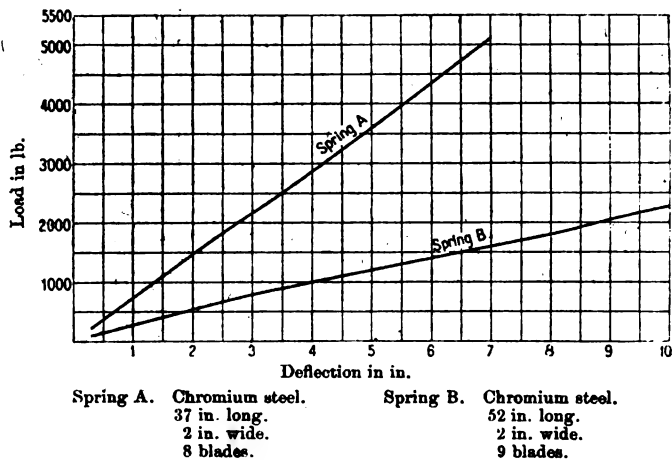


Fig. 7.—Deflection curves of springs.

Table I shows the static deflection and the additional deflection measured under varying conditions in a particular case of normal semi-elliptic suspension, as an example of the methods adopted in the determination of the foregoing values.

Permissible Stress

The permissible static stress for a rear spring is therefore from 0.5 to 0.6 the maximum safe stress, and for a front spring from 0.3 to 0.4 the maximum safe stress.

The maximum safe stress can approach the point at which permanent set takes place, and the author finds from experience on cars under working conditions and from over-stressing actual springs in a testing machine that the following figures are practicable:

Minimum tensile breaking strength—

Carbon steel, 80 tons per sq. in.
Alloy steel, 90 tons per sq. in.

Maximum safe stress—

Carbon steel, 50 tons per sq. in.
Alloy steel, 65 tons per sq. in.

Maximum permissible normal static stress—

Carbon steel, front springs, 20 tons per sq. in.
Carbon steel, rear springs, 30 tons per sq. in.
Alloy steel, front springs, 24 tons per sq. in.
Alloy steel, rear springs, 36 tons per sq. in.

These stresses are calculated on the formula:

$$f = (6WL)/(4bt^3)$$

The working stresses appear high in relation to the breaking strength of the material, but it must be remembered that they are calculated by the ordinary beam for-

*Limit of clearance.

**See also table given by Dr. F. W. Lanchester, Proc. I. A. E., Vol. II, p. 192.

mula which gives values which in extreme cases are possibly 50 per cent higher than the real stress, and also that the laminated spring is stressed in one direction only, and the over-stressing in this direction during the first "scragging" operation has the effect of raising the point at which permanent set takes place when the spring is re-stressed.

A schedule showing a few examples of the stresses adopted in various springs taken from current practice is given in Appendix III. The values given as maxima are for properly designed springs in which the stress is reasonably uniform throughout, and if it is required to apply them to springs in which the ratio between maximum stress and mean stress is not negligible, due allowance must be made.

Flexibility

The property of the steel that is called into play in a spring is its ability to bend, which is effected by stretching the fibers on one side of the blade and compressing those on the opposite side to an approximately equal extent. It is probable that little, if any, actual stretching or compression takes place, most of the movement being due to alteration in form rather than alteration in volume.

When springs are loaded so that the strain exceeds the limit of proportionality, the modulus of elasticity alters, and while it is probably constant for a given material for any particular fiber stress, and variations below the elastic limit are so small as to be negligible for the present purpose, it is not the same at all fiber stresses.

Deflection

The deflection of a spring within the elastic limit follows exactly the same laws as a beam. The deflection is proportional to the load and is expressed by the formula:

$$d = (WL)/(4bED^3)$$

For the case of a laminated spring nt is conveniently substituted for the depth of the beam D , when the formula becomes:

$$d = (WL)/(4bEnt^3)$$

The length of a cambered spring changes with alteration in load, so that although the spring theoretically follows a straight line law for load deflection, in practice, due to this length alteration, the load deflection curve may not be quite a straight line. For this reason it is usual for the rate of deflection of a spring to be defined by dividing the normal load by the deflection at normal load.

Typical load deflection curves are shown in Fig. 7, where the particulars of the springs tested are given in detail.

Departure of the load deflection curve from a straight line, due to change in length with change in camber, has been taken advantage of to secure a variable rate of deflection, but the resulting high cambered spring is objectionable and the riding is not so smooth as that obtained from a flat spring that articulates on each side of the flat position.

TABLE II
TABLE OF SPRING DEFLECTIONS AND PERIODICITIES**

Deflection in in.	Periodicity Complete Oscillations Per Minute	Deflection in in.	Periodicity Complete Oscillations Per Minute
39.1	30	2.5	120
14.1	50	2.1	130
9.8	60	1.8	140
7.2	70	1.5	150
5.5	80	1.35	160
4.4	90	1.2	170
3.5	100	1.1	180
2.9	110		

In automobile practice, where springs are practically flat in the loaded position, it is usual and sufficiently accurate to take the straight or sector length as the value of L both in the strength and in the deflection formula. In this latter formula, where L' is the expression, one L is the sector length derived from the bending moment WL , while the other two L 's represent the curved length of the blade. The use of the sector L only, the smaller of the factors, introduces an inaccuracy which approximately compensates for the fact that the value t in the expressions bt' and bt'' is conveniently taken as the normal thickness of the plate, which is greater than the actual mean thickness on account of the concavity.

The tendency of these inaccuracies to balance one another does not make a satisfactory arrangement from the mathematical point of view, and would introduce serious inaccuracies in calculations for any but approximately flat springs made of blades of commercial dimensions, and, therefore, the use of the simple formulæ given must not be extended to general applications without having appropriate corrections applied.

Periodicity

The rate of oscillation of a spring suspended system is dependent on gravity, and follows the same general laws as the pendulum and the governor. The basic formula for expressing the time of an oscillation is $t = \pi \sqrt{l/g}$, where t is the time of one oscillation and l is the deflection, which is the amount by which the spring is deflected statically by the load under the action of gravity from its free position. This formula is only strictly applicable to theoretical conditions, represented by infinitely small oscillations of a frictionless spring in a vacuum, but the modifications to represent actual practice are small, and may be neglected. The formula ignores amplitude, and within the limits of laminated suspension springs amplitude makes little alteration to the periodicity, its principal effect being to modify the friction effect.

For spring calculations, the formula can be more conveniently expressed in inch-minute units as $P^2 = 35230/d$, P being the number of complete oscillations per minute and d the static deflection.

The relation between the rate of oscillation and the amount of deflection calculated from this formula is shown in Table II and graphically in Fig. 8, from which particulars the comparatively close practicable limitations of suspension period can readily be seen, these being at the one end excessive deflection and at the other extremely rapid oscillation.

The periodicity of a spring can be readily measured to a considerable degree of accuracy by means of a device such as that shown in Fig. 9. Representative diagrams taken with an apparatus of this type are shown in Fig. 10, and these give some idea of the way in which the spring oscillations die out due to friction when the exciting cause is removed.

Periodicity of a Suspension

The periodicity of a suspension has to be considered as a whole, as all portions act in unison to produce a resultant, and the separate components cannot oscillate independently of each other.

A suspension has different natural periods in the several planes, normally one period only for each plane. In the case of a motor car, these can be divided into:

1. The front suspension vertical period.
2. The rear suspension vertical period.
3. The rolling period.
4. The pitching period.

Each of these will be different, and furthermore it will

be found that the rear and front springs interact, and that, for example, the rear vertical period will be slower if the front springs are free than if they are locked, as the movement of the free front spring alters the amplitude of the mass and so modifies the time of swing to an extent that depends upon the weight distribution and other variables.

The rolling period and the pitching period both result from the combined action of all the springs, front and rear. The former is largely influenced by the height of the center of gravity above the suspension level, and is usually considerably slower than either of the vertical periods, while the latter depends on wheelbase and weight distribution longitudinally.

The difference between the rolling and the rear vertical periods and the small practical range of periodicity constitute the principal disadvantages of normal suspen-

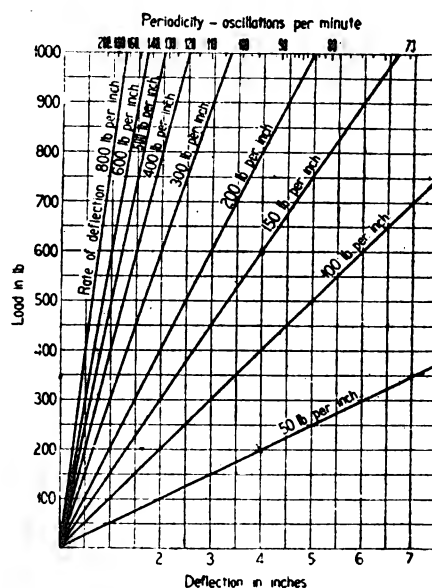


FIG. 8.—Relationship between load, deflection and period.

sion systems and indicate the most promising directions in which to seek for improvement.

Internal Friction

The effect of friction between the leaves is to damp out the oscillations gradually as is seen by the graphs shown in Fig. 10 already referred to. This effect has been investigated by Mr. G. H. Baillie,* who tested springs with varying amounts of internal friction and also ascertained experimentally the effect of frictional shock absorbers.

The amount of friction in a laminated spring as ordinarily made is small, but is useful in damping out oscillations more quickly than would otherwise be the case. It is doubtful if any considerable increase of friction, either by a modification of spring design or by the addition of shock absorbers, is desirable except in extreme cases, such as on racing machines, where wheel adhesion and ability to hold the road take precedence over comfort.

Resistance to Torsion

Laminated springs present considerable resistance to torsion, especially when under load, due to the lessened tendency for the leaves to separate, and this resistance, on account of the methods of mounting adopted, stiffens the usual forms of suspension in their resistance to rolling. In this respect the semi-elliptic spring is superior to the cantilever, as both ends of the former are effective, and as the greatest possible resistance to rolling is desirable, this lessened torsional resistance may be considered a defect of all simple cantilever suspensions.

*See Proc. I. A. E., Vol. VII, p. 451.

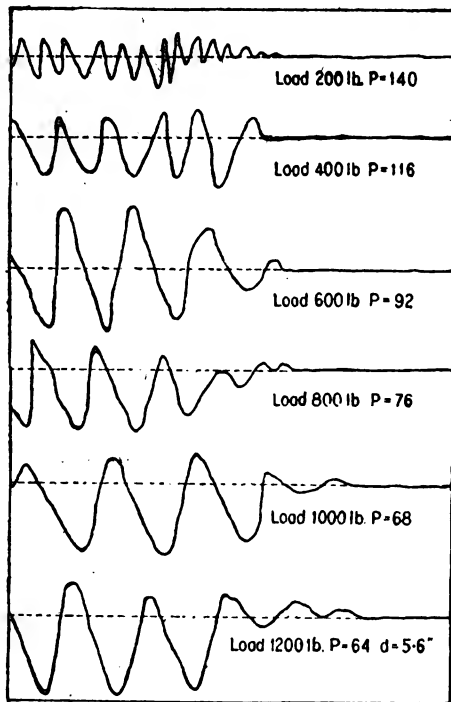


FIG. 10.—Actual periodicity diagrams from a 52 in. by 2 in. 9-blade spring.

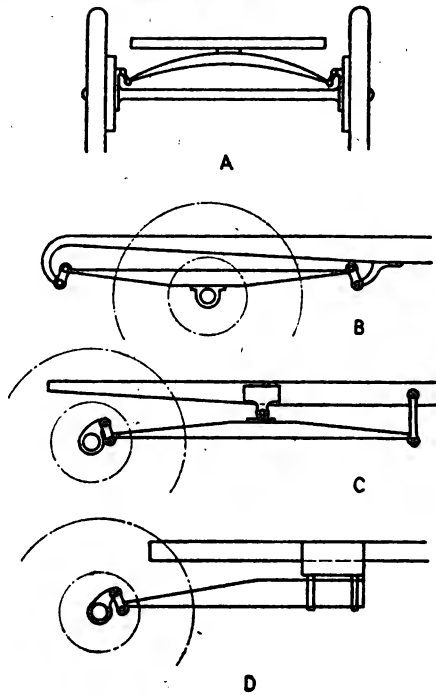


FIG. 11.—Forms of suspension.

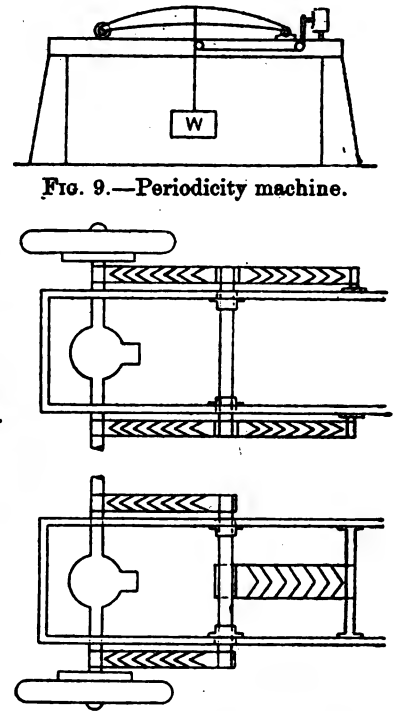


FIG. 12.—Anti-rolling suspension.

The author regrets that he has not been able to carry out experiments in order to provide quantitative results in regard to the resistance of normal springs to torsional deflection, but hopes to contribute some data on the subject at some future time.

Effect of Mounting

Other factors remaining unchanged, the type of spring and the manner in which it is mounted have little effect on the suspension. The method of fixing or pivoting the springs on the frame affects the resulting action, but only in so far as it modifies the degree of freedom or direction of articulation of the parts.

The usual forms of normal rear suspension can be expressed by four groups, as shown in Fig. 11.

(a) A transverse spring fixed to the frame at the center and linked to the axle at each end.

(b) Two semi-elliptic springs, one at each side, pivoted to the axle at the center and linked to the frame at each end.

(c) Two cantilever springs, each linked to the axle at one end, linked to the frame at the other, and pivoted on the frame at the center.

(d) Two half-cantilever springs linked to the axle at one end and fixed to the frame at the other.

These four forms of suspension make no difference to the external effect provided that the rate of deflection is the same, and that the axle is articulated in respect to the frame in the same manner, but they only modify the internal effect, particularly as regards the stresses and stress distribution in the various members.

Articulation of, or interconnection between, the various springs, by altering the degree of freedom, affects the suspension, usually more particularly in the direction of degree of stability; for example, if in the case of group (a) the spring were pivoted on the frame at the center, instead of being fixed to it the suspension would lose all lateral stability, or resistance to rolling; and if in group (c) the springs, instead of being independently pivoted on the frame, were interconnected at their centers by a shaft fixed to each of them and carried in bearings on the frame as shown in Fig. 12, the suspension would not be

altered as regards vertical movement but would have enhanced resistance to rolling. This latter arrangement is covered by patents taken out by the author and in use by Messrs. Wolseley Motors, Ltd.

The primary rhombus is equally and similarly stressed on every section, as shown in Fig. 13 at A, where

$$WL = f(bt^3/6)$$

Also, a laminated spring conforming to the rhombus law is in a similar condition, as shown at B, where

$$WL = f(bnt^3/6)$$

$$Wl = f(bt^3/6)$$

$$Wnl = f(bnt^3/6) = WL$$

Each blade, except the shortest, is loaded in a similar manner, as shown at C, where again

$$WL = f(bt^3/6)$$

the bending moment being proportional to the section throughout, and constant where the section is uniform. The fiber stress on every section being the same, the load on the tip of each blade must also be the same and is the load carried by the spring, the maximum bending moment being proportional to the number of blades, i. e., to the number of sections into which the rhombus is divided.

Departure from Primary Rhombus

When the primary rhombus is departed from, or the blades are cambered to differed radii, the uniformity of stress distribution disappears, and the effect of such departures can be foreseen. For example:

1. Full width instead of spear-shaped blades will increase the bending moment and the fiber stress on the short blade, and reduce the stress on the other blades.
2. Overlength blades will have the same result.
3. "Nip" will have the same result.
4. "Grading" without "nip" will reduce the stress in the shorter blades and increase it in the longer blades.
5. Additional full length blades will have the same effect as overlength blades.

A spring proportioned according to the rhombus law is shown in Fig. 14 at A, and one with overlength blades at

B. If truly cambered to a circular curve, the overlengh blades will bend irregularly, due to the irregularity of stress, and will not remain in contact when the spring is loaded. "Nip" seriously affects the stress distribution, but has little effect on the load-deflection curve. At D, Fig. 15, a three-blade spring with all full-length blades is shown. If this spring is made without "nip," the stress

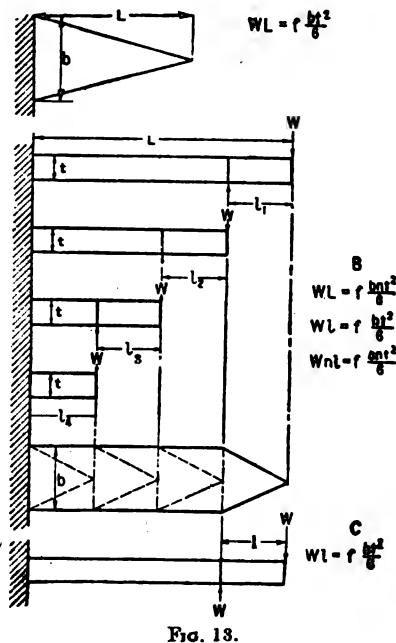


FIG. 13.

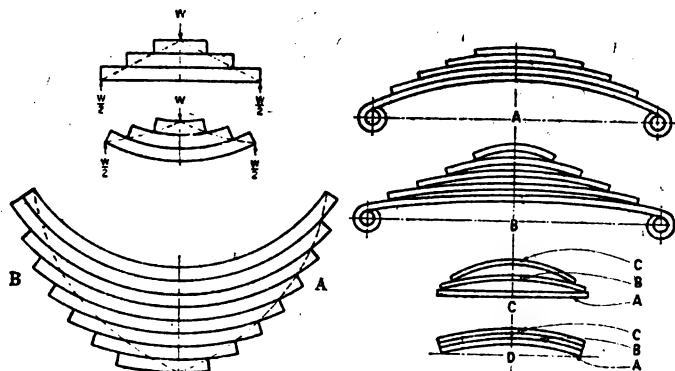


FIG. 14.

FIG. 15.

in each blade will be the same when it is loaded, but if a second spring is made with "nip" as shown at C, although the nipped up springs will appear identical, and the load deflection curve within the elastic limit will be the same, the stress distribution will be entirely different.

Taking the proportions shown, when pressed flat the lower blade of the spring with "nip" will not be stressed at all, and the whole of the stress that would be carried by it if the spring were made without "nip" will be carried by the topmost blade, which will thereby be stressed to twice the amount to which it would be if the spring were made without "nip." Therefore, in this particular extreme case, the maximum stress in the spring with "nip" will be twice the mean stress, and while the load deflection curves will be identical, the maximum safe load for the one spring will be only half that for the other.

A Foreign Book on Fuel and Lubricants

BOOKS intended for both scientists and laymen, as a rule, are not very practical because they will either be above the heads of the latter or else of no use to the scientist or engineer. Dr. J. Formanek, Professor at the Bohemian Technical High School at Prague, has, however, written a thoroughly practical manual. This book, entitled "Benzine and Mineral Lubricants," has been translated from the German by Charles Salter and is being published by Scott, Greenwood & Son. D. Van Nostrand Co. is the American agent.

The "benzine" with which this book deals is really gasoline, and it is hard to understand why the translator did not choose the word petrol instead of benzine. The book is addressed on the one hand to automobile owners, owners of internal combustion engines, automobile engineers and all who have to do with the testing of fuels and oils, and, on the other hand, to chemists who are called upon to report on motor fuels and lubricants. Owing to this double purpose the author has endeavored to keep down the size of the work.

The average automobile owner in this country may not be particularly interested in the chemistry, production and scientific testing of gasoline and other motor fuels, but in judging this phase of the author's appeal the fact must be taken into account that it was originally written during the war period in one of the Central Empires at a time when getting fuel for a car was not merely a matter of driving a block or two to the nearest filling station, but when practically any liquid that would serve as fuel in internal combustion engines was given a trial. It is not hard to understand that under those conditions private owners of motor vehicles were willing to go somewhat more extensively into the sci-

ence of motor fuels than the average automobile owner in this country to-day.

The book will probably be of particular interest to petroleum chemists, as it deals chiefly with the methods in use in the Galician oil fields and the refineries supplied by them. It should, however, also prove of interest to the automobile engineer, in view of the constantly changing character of our fuel and the many problems raised thereby. It deals especially comprehensively with testing methods. The following list of chapters will give a good idea of the field covered: Petroleum, Its Composition and Treatment; Coal Tar Products; Brown Coal, Shale and Peat Tar Products; Products from Petroleum and Tar Residues; Testing Benzine and Benzol; Judging the Quality of Benzine and Benzol; Testing Mineral Lubricating Oils; Judging Mineral Lubricating Oils; Properties and Uses of Fuels; The Consumption and Efficiency of Various Fuels in Internal Combustion Engines; Suggested Improvements in Motor Car Equipment; Safe Storage of Benzine and Benzol; First Aid in Cases of Gassing with Benzine.

AMONG other conclusions, in a monograph "China: Automotive Conditions and Good Roads Movement," the author, J. Morgan Clements, American Trade Commissioner, states that although China's increasing interest in road building is an encouraging sign, American manufacturers should by no means jump at the conclusion that an immediate market will be created for large numbers of motor cars and trucks.

This monograph may be obtained on application to the Automotive Division, Bureau of Foreign and Domestic Commerce, Washington, D. C.

Fig. 2—Parts order

facilitates making up an assembly, when so desired, by listing the piece numbers, names, amount used and location of all the component parts. The obsolete part card advises the piece number, name and location of the superseding part. The parts not stocked card gives piece number, name and reason for not stocking. This master file serves to give to the employees all information regarding parts and their location.

Stock Record System

The key to the entire stock keeping system is the stock record card, and it is essential that this be understood before going on to describe the system. Every part stocked by the stock department has its own record card (Fig. 1), which is kept in the stock record office. This card contains the following information regarding the part: Piece number, name of part, location in bin, list and cost price, columns for all information regarding ordering, receiving and disbursement and main and sub-stock room danger limits. A danger limit is a predetermined figure showing the lowest amount of each part that can be carried safely. When the balance of parts on hand bears the same figure as the danger limit, the record clerk attaches a red tag to the card. This danger limit is determined by the length of time that it takes to obtain shipments from the factory, which varies from two to four weeks, according to whether the material comes by express or freight.

The installation of a danger limit insures getting parts before the supply runs out and eliminates guesswork in ordering.

The same system of recording stock is used for parts stocked in the sub-stock rooms. In the recording office a separate file is kept for each sub-stock room and in each file is a record card for every part stocked. The method used in keeping this record card file will be dealt with as the various factors connected with it are outlined.

Ordering

All parts, whether coming from the factory or locally, are ordered by the order clerk. Very few parts are purchased locally, but the system is the same in any case. The order clerk collects the red-tagged record cards daily and immediately makes out an order from them in duplicate (Fig. 2). This order shows the quantity ordered, piece

number, name of part, bin number and location in stock room and a place for the factory invoice number. The original copy is forwarded to the factory and the duplicate to the invoice clerk. Every effort is made to order in such a way that parts are brought through in carload lots. This brings shipments faster than broken carload lots and practically secures express service at freight rates. As each part is ordered it is entered on the stock record card with the following information: Date of ordering, order number and quantity ordered.

Receiving

When parts are received from the factory they are immediately unpacked in the receiving room. A tally sheet accompanies the shipment, which is a carbon copy of the factory invoice to Long Island. The tally sheet is forwarded to the invoice clerk, who fills in the bin location which is obtained from the factory order, at the same time checking it against the factory order for quantity received, change in piece numbers and prices. To indicate a change in piece numbers a card (Fig. 3) is used which is filed in the master file in the main stock room. In this way any superseded piece numbers will be caught and new record cards installed before the parts are placed in the bins. After this is done, the tally sheet is returned to the receiving clerk, who checks in the parts, inspects and verifies the quantities as shown on the tally sheet. Parts are then put away, using the bin location furnished on the tally sheet.

When stock is received, the following information is entered for each part on its respective record card: Order number (in red), quantity actually received, balance due, if any, and factory mail order number on which the parts arrived. The mail order number and quantity received is then copied on the disbursement side of the record card, showing the new balance.

Disbursement

There are three distinct divisions in the disbursement of stock. In order to show how this part of the work is handled, each division will be taken one at a time.

The crew of men who disburse parts from the sub-stock rooms began in the department by receiving and checking in, and in that way have become acquainted with the different parts, the method of stocking and their location.

The image shows four overlapping forms used in an automotive stock management system. The top form is a 'CHANGE NOTICE' (Fig. 3) with fields for Piece No., Location, Description, and Order No., and a section for 'HAS BEEN CHANGED TO'. Below it is a 'DISCONTINUED ASSEMBLY' card (Fig. 4) with fields for Piece No., Model, Location, and Description. To the left is a 'PART NOT STOCKED' card (Fig. 6) with fields for Piece No. and Remarks. In the foreground is an 'OBSOLETE PART' card (Fig. 5) with fields for Piece No., Model, Location, Name, and a section for 'SUPERSEDED BY PIECE NO.'. The forms are numbered 3, 4, 5, and 6 in small circles.

Fig. 3—Change notice card. Fig. 4—Discontinued assembly card. Fig. 5—Obsolete part card. Fig. 6—Part not stocked card

As the stock from the sub-stocks is disbursed solely to the shops and hence used for replacement in repair work, every request for a part must appear on a requisition and bear the order number of the job in which it is to be used. The requisition is made out in triplicate, the original and duplicate copies are forwarded to the record office, where they are priced, then the former is sent to the cost department, where it is put in the job order envelopes, the latter remaining in the office. The third copy remains with the requisition writer as his reference.

All requisitions filled from sub-stock are stamped with a rubber stamp indicating it. The requisition is then forwarded to the record office, and from the information thereon the proper disbursement is made on the stock record card. When the supply shown on the record card reaches the danger limit, the record clerk makes out a transfer to replenish the sub-stock from the main stock. This transfer itself is made by the night man. This system has two advantages: the sub-stock man is not engaged in handling records and orders and can devote his entire time to waiting on the shop, and the stock is transferred at night without confusion.

The parts ordered by dealers, branches, mail, telephone and telegraph customers are drawn from the main stock and the proper disbursement entries made on the stock record cards. Stock thus drawn is sent to the shipping department, checked and shipped in the usual way. The men who handle these orders have been promoted from the sub-stock rooms.

Direct customers, the third division, are cared for by a group of men who have been through the entire system and are ready to give expert service as a result of their previous stock experience. Customers' orders are written on cash sale or charge part orders. In the case of cash sales, the order is written in triplicate. All copies are priced and the original and duplicate handed to the customer, who, after paying the cashier and having it stamped, returns the copies. The triplicate is wrapped

and delivered with the parts. The original and duplicate are forwarded to the accounting and record office respectively, the latter giving information from which to make the proper disbursement on the record cards. In the case of charge accounts the system is the same, only in place of paying the cashier, the customer has the orders approved by the credit department.

In order to facilitate the handling of parts for large fleet owners who operate in several states, one man handles all these so-called national accounts. His only other duty is to take charge of returned parts. The national accounts man becomes personally acquainted with the representatives and a closer contact is secured by this system.

Branch Stock System

A close supervision is maintained over the branches, and in order to understand the system of stock handling it is well to know that the same record card system is used.

The method of handling stock at the branches used previously to the one about to be described is briefly as follows: Parts were ordered directly from the factory, and there was no absolute limit as to the maximum supply of each part to be kept on hand, this being left largely to the discretion of the branch stock manager.

Difficulties arose from that method for several reasons. In the first place, the tendency was to carry far too much stock, thereby cluttering up the stock room and tying up more capital than was necessary. Also, the stock managers were constantly being bothered by salesmen in an effort to make the branches carry a different line of locally bought stock, such as brake lining, accessories, etc. It meant that the stock managers had to be better buyers than the New York purchasing agent, or the branches would suffer from inferior goods, or goods not up to the standard set by the factory.

A maximum-minimum system is now used and it is required that all parts be ordered directly from the main office at Long Island. The amount of stock necessary for each branch to carry has been determined from three sources, as follows, on a basis of:

1. Sale of parts for the previous three months.
2. Sales for the corresponding three months of the previous year.
3. The number of cars in the locality.

By taking the figures from these three sources and blending them a very accurate figure capable of caring for the increase per year, local and seasonal business, is obtained. Having determined the maximum amount of parts to be stocked, a minimum is set as well as a danger limit determined, the latter being approximately half way between the maximum and minimum figures. Here, again, the danger limit is determined by the length of time that it takes to replenish the supply.

A record file is kept at the Long Island record office, containing a card for every part stocked at the branches. These cards (Fig. 7) are filed numerically according to piece number, each card containing the names of the branches and the maximum, danger limit, and minimum figures for each branch.

When an order comes in from a branch it is possible to tell by a glance at the branch file whether the stock manager has ordered more than enough to reach the maximum, in which case the surplus is not sent, and the man risks losing his position. Of course, stock suddenly depleted below the danger limit must be replenished, but a notation to that effect would accompany the order.

Let us see the advantages accruing from this system. The investment in parts is kept at a minimum and yet good service is assured. The purchasing responsibility rests on one man, who is a specialist. Only active parts are carried and the inactive parts are centralized in the excess and surplus divisions of the main stock room and

not lying fallow at the branches. The flow of parts is facilitated by quantity ordering, as duplication and friction is avoided and better express and freight rates secured.

Assuming that the main office is not able to furnish an exceptionally large order of a certain part, it is possible, knowing the branch minimums, to wire the nearest branches to ship their minimum to the given destination. This brings the branch supply down to the danger limit and immediately an order is sent to the factory to replenish the main and branch stocks. In the meantime the customer has had real service.

In connection with branch stock it would be well to mention that this maximum-minimum system has been carefully worked out and is at the disposal of the company's dealers, if they care to adopt it. Any wide-awake dealer can see the advantage of giving maximum service at minimum cost, and it is also to the advantage of the company, in the long run, to aid the dealer in reducing his capital investment in parts and yet give service as it should be given.

Inventory

The taking of inventories has always been more or less of a nightmare to most concerns, hence any system which removes some of the difficulties has secured a measure of success.

A thorough inventory has been taken in two days and a night. The method consists in filling up the sub-stock supply, closing the main stock for inventory and during that day supplying parts from the sub-stock. After the main stock has been inventoried, all drawing of stock is made from the main stock while the sub-stocks are closed and inventoried.

The taking of an inventory starts with the making up of a bin index (Fig. 8), which is simply sheets of paper with columns of numbers from 0 to 100. These sheets can be expanded indefinitely for each bin section by the mere addition of a numerical suffix to the numerals. Piece numbers are then written on the sheets beside the numbers which correspond to the respective bin numbers. This is done for every bin and acts as a positive check on the stock room. The next step is to write an inventory count card (Fig. 9) for every stock record card in the record office, giving the piece number, name of part and location.

BROOKLYN				
WHITE PLAINS				
NEWARK				
PATERSON				
JERSEY CITY				
HARTFORD				
NEW HAVEN				
NEW LONDON				
SPRINGFIELD				

Fig. 7—Main office branch stock card

This should give a count card for every piece number in the bin index.

Having completed the bin index and inventory count cards, the latter are arranged in numerical sequence (bin number sequence) and according to sections. The cards are then checked against the bin index to check for piece numbers and locations, also to insure having a count card for every piece number. Any stock without a count card

Fig. 8—Bin index sheet. Fig. 9—Inventory count card

shows bad location of stock, misplaced stock record card or a lost count card.

The inventory count cards are placed in their respective bin locations according to bin number and section, or, in other words, in numerical sequence. The parts are counted, recounted by a second man and finally audited by a man from the accounting department, each man initialing card after counting. The cards are then taken out of the bins in their numerical sequence and returned to the record office, where they are checked against the bin index to insure the return of all cards.

The final step is to enter the inventory count from the count cards on to the stock record cards. If there is no discrepancy, the balance on hand on the stock record card and the inventory count on the inventory count card should be identical. Inventory sheets are then made up to show the total inventory.

If the system has been kept up with care during the year there is no reason why there should be a big discrepancy between the actual inventory and the inventory that the books show.

Conclusions

To the question: "Doesn't this system require an abnormally large force to handle all the necessary records properly?" Mr. F. Preston, the manager of the stock department, replied that it requires fewer employees than the average system. In connection with this, the service rendered, investment involved and volume of business should not be forgotten. The present system has resulted in a decreasing of one-third of the capital invested in stock, while the efficiency of the department has steadily increased. This may certainly be said to be traveling in the right direction.

A DESCRIPTIVE Handbook on General Instrument and Oxygen Equipment for aircraft has been issued by the Air Ministry (Directorate of Research) of Great Britain. Copies can be obtained from H.M. Stationery Office, London.

S. A. E.'s Recent Standardization Work

Revision in ball bearing standards to secure agreement with the German standards under consideration. Iron and Steel Division discussing Bessemer steel and wire spring stock. Distributor, magneto and bumper mountings, motorboat controls and passenger car frames considered by divisions.

THROUGH the efforts of the Sectional Committee on Ball Bearings of the American Engineering Standards Committee an attempt is to be made to secure uniformity between present and proposed German and American ball bearing standards. The Sectional Committee has made certain requests to the sponsor bodies for ball bearings, the Society of Automotive Engineers and the American Society of Mechanical Engineers, and as far as the S. A. E. is concerned the requests will be considered at the next meeting of the Ball and Roller Bearings Division of the Standards Committee. The requests made are as follows:

Requested Changes in Ball Bearing Standards

"That the Society investigate the German extra light series of ball bearings and give careful consideration to the advisability of establishing a corresponding S. A. E. standard.

"That the society make a careful study of the proposed German light series extra large standard, and if possible change the outside diameter for the corresponding S. A. E. standard to agree with the outside diameters adopted by the German Standards Committee; and that the widths adopted by the German Committee should be thoroughly considered. The Sectional Committee believes, however, that the narrow widths will not permit satisfactory design of radial bearings carrying an appreciable thrust-load and that they are not suitable for the design of double-row ball bearings with spherical outer races.

"That the Society make a careful study of the proposed German medium series extra large standard, and if possible change the outside diameters of the present S. A. E. standard to agree with the outside diameters adopted by the German Standards Committee.

"That the Society make a careful study of the proposed German heavy series standard and change the outside diameters for S. A. E. bearings above 85 mm. bore of the heavy series to agree with the outside diameters adopted by the German Standards Committee.

"That the Society consider (a) changing the outside diameters of the light, medium and heavy series double-row bearings to conform with such outside diameters as are finally adopted for the single-row bearings; (b) changing the S. A. E. Standard to bring the widths of the S. A. E. and German standards together, or to change the inch widths to millimeters; (c) investigating the possibility of a demand in America for a narrower series of double-row ball bearings than the present S. A. E. Standard.

"That the Society consider changing the S. A. E. Standards so that they will conform with the corner radii adopted by the German Standards Committee, particularly in view of the fact that it is stated that the S. A. E. corner radii are too small.

"That the Society consider the German standard width-tolerances and indicate what recommendation should be made for standard width-tolerances in American prac-

tice, as well as what would be the result in America if the closer German tolerances were adopted."

In connection with the size standards the Sectional Committee suggests that in studying the possible change of outside diameters the Society endeavor to omit some of the intermediate sizes, particularly in the heavy series, and that the outside diameters of the series be selected so that as few outside diameters as possible are necessary, to reduce the necessary tool equipment.

In the present S. A. E. Standard for distributor mountings it is specified that the distance from the base of the distributor body to the end of the coupling tongue shall vary to suit conditions. It had been suggested that this dimension be standardized, and a subdivision of the Electrical Equipment Division consisting of W. A. Chryst has now recommended that the following revisions be made:

- (1) Specify a dimension of 27/32 in. for the distance from the base of the distributor body to the end of the coupling tongue of the Type-B ignition-distributor.
- (2) Change the limits for the bore of the collar from 0.4930 in. maximum and 0.4920 in. minimum to 0.4915 in. maximum and 0.4905 in. minimum.

The dimension of 27/32 in. is in accord with present practice. The revision in limits does not affect the actual manufacturing tolerances now specified for each part, but results in closer fits, 0.0020 in. maximum and 0.0005 in. minimum instead of 0.0035 in. maximum and 0.0020 in. minimum, between the collar and the shaft. As it is thought that the fit of the tongue and the groove is more important than that of the collar and the shaft because there is more wear between the former than between the latter, no revisions of the present limits are recommended.

Passenger-Car Bumpers

In 1921 a questionnaire was sent to passenger-car builders as to the feasibility of standardizing a plain bolted-on connection for passenger cars using the conventional type of pressed-steel frame. Although it was pointed out that the adoption of such a standard would necessitate providing holes in the passenger-car frame in conformity with whatever standard was proposed, these holes to be used either by the passenger-car builders for mounting bumpers as standard equipment or by the owners for mounting bumpers as accessories, over 90 per cent of manufacturers replying to the questionnaire recommended the formulation of such a standard bumper-mounting.

A Subdivision, consisting of F. G. Whittington and E. W. Weaver, appointed for the purpose, has recently made the recommendation given in the accompanying figure:

Two 33/64-in. diameter bolt holes shall be located on or near the neutral axis of the frame section.

The first bolt-hole from the frame horn shall coincide

with the first or second rivet hole and shall be located at least 1 in. above the frame-horn lug. Clearance must be provided for the bolt-head inside of the frame channel.

The second bolt-hole shall be located on a line passing through the center of the first bolt-hole at an angle of 15 deg. plus or minus 2 deg. above the horizontal and at a distance from the first bolt-hole of from $3\frac{3}{4}$ to $4\frac{3}{4}$ in. In cases where the second bolt-hole is to be used for mounting a shock absorber, the hole shall be located not more than $1\frac{7}{16}$ in. from the bottom of the frame channel at the nearest point.

There should be normally a clearance of $\frac{1}{4}$ in. between the side rail and bumper bracket so that the latter will clear the rivet heads.

In case passenger cars are not equipped with bumpers as standard equipment, it is intended that a flat-headed

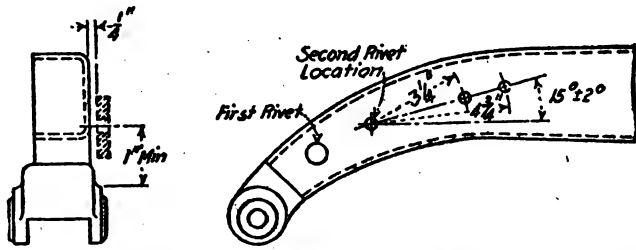


Fig. 1—Proposed recommendation for passenger-car bumpers

bolt shall be used in place of the first or second rivet to facilitate mounting bumpers as accessories.

Iron and Steel Specifications

The matters outlined below were brought out at the February Iron and Steel Division meeting:

Chemical Compositions.—The suggestion made by E. A. Johnston of the International Harvester Co., to reduce the standard carbon-steels to the least number required was discussed in connection with present practice among steel producers and parts manufacturers. A conference on the subject is to be arranged between the members of the Division and representatives of the International Harvester Co. and other implement manufacturers.

It was stated that at the present time there is no composition in the carbon steel group suitable for steel spring wire. The steel used by the steel-wire manufacturers ranges around 0.65 per cent carbon and 0.75 to 1.05 per cent manganese, but it is thought that if there were an S. A. E. Steel designated as Steel 1065 concerted effort among steel mills would practically bring about its universal use. S. A. E. Steel 6150 is easily obtainable and used to some extent for the purpose in mind, but the greater volume of spring wire is made from carbon-steel. It is understood that the steel-wire mills required the specially high manganese content in the carbon steel because of difficulties in the drawing operations encountered with lower manganese steels.

Chairman Gilligan of the division appointed a subdivision with A. L. Danse of the Cadillac Motor Car Co. as chairman to investigate the practice of the steel wire mills and prepare a tentative report for the division.

Bessemer Steels.—Attention was given to the subject of standardizing bessemer-steel specifications, as the following comments had been submitted:

Outside of S. A. E. Steel 1112, screw stock, which could be a bessemer steel, the automotive engineers are strongly in favor of the open-hearth process, due largely to the low phosphorus content possible in open-hearth steels. However, the attitude toward bessemer stock is not altogether justified, as perhaps 85 per cent of the

steel going into the products of a large number of the implement manufacturers is bessemer steel.

The opinion was expressed that if bessemer steels were included in the specifications, there would be danger of automobile manufacturers using them when open-hearth steels are not readily obtainable. The Division members present were of the opinion that it would be unwise to mix steels such as the bessemer types, which are used by the agricultural implement manufacturers, with those now included in the S. A. E. Steel Specifications which are used by the automobile and tractor industries. As it was deemed inadvisable to make a final decision, it was voted to table the subject until further information should have been received.

Cast Iron.—The suggestion that the Division take up the matter of the adoption of standard specifications for cast iron was discussed. Previous attempts of the Division to prepare such specifications were mentioned and the opinion expressed that before the subject is taken up, tentative specifications for as many grades of cast iron as may be considered necessary should be submitted. It was noted that the tendency is toward specifying the grades of cast iron according to the Brinell hardness instead of by chemical analysis.

Sheet Steel.—A progress report was submitted from W. C. Peterson that data are being collected for a general specification for sheet steel and that a tentative report should be ready for consideration by the Division at the next meeting.

Leaf-Spring Stock

At the Iron and Steel Division meeting held on Oct. 21, 1921, M. P. Rumney explained that there is lack of uniformity of practice in rolling leaf-spring stock and that the following proposal, which had been submitted by the Leaf-Spring Group, is the best compromise that could be made between the varying practices in different mills. It was decided to circularize the proposal among manufacturers and users of leaf-springs for comment.

Rolling Tolerances for Concave Automobile Spring Steel

The finished bars shall be of double-concave section with round edges. The radii of the arcs of the two concave surfaces shall be of equal length.

Rolls to produce the round edges shall be turned to a radius equal to two-thirds the thickness of the bar.

All bars ordered to gage shall be rolled to the Birmingham wire gage.

All bars must meet the width and thickness tolerances specified in Table 1.

TABLE 1—WIDTH AND THICKNESS TOLERANCES

Width of Flat, in. Over	To, Inclusive	Width, in.		Thickness, ¹ in.	
		Plus	Minus	Plus	Minus
0	$2\frac{1}{4}$	$1/32$	0	0.005	0.005
$2\frac{1}{4}$	3	$3/64$	0	0.006	0.006
3	5	$1/16$	0	0.007	0.007

The difference in thickness between the two edges of each bar shall not be greater than those given in Table 2.

TABLE 2—DIFFERENCES IN THICKNESS

Width of Flat, in. Over	To, Inclusive	Difference in Thickness, in.
0	2	0.002
2	3	0.003
3	5	0.004

Spring-steel bars shall not have more than 1 in. curvature in 20 ft., or $1\frac{1}{4}$ in. in 25 ft., or $1\frac{1}{2}$ in. in 30 ft.

¹Thickness measurement to be taken at edge of bar where concave surface intersects round edge.

The concavity, the difference between the thickness at the edges and at the center of the bar, shall be as specified in Table 3.

TABLE 3—ALLOWABLE VARIATIONS IN CONCAVITY

Width, in.	Nominal Concavity, in.	Maximum Concavity, in.	Minimum Concavity, in.
1½	0.007	0.009	0.004
1¾	0.008	0.010	0.005
2	0.010	0.012	0.006
2¼	0.011	0.013	0.007
2½	0.013	0.015	0.009
3	0.016	0.018	0.012
3½	0.018	0.020	0.013
4	0.021	0.023	0.016
5	0.029	0.031	0.023

Motorboat Controls

Further standardization of motorboat controls has been suggested. It would be helpful if a standard reverse-control mechanism could be provided on all standard marine engines so that the motorboat builder could connect standard bridge-deck controls direct to the engine builders' control equipment, which it is impossible to do on any standard marine engine to-day, for it is necessary for the motorboat builder to throw the regular reverse lever away and build his own controls from the bridge-deck control position all the way to the reverse gear.

The same conditions apply in every respect to the spark and throttle controls, as the engine builders only provide brass levers here and there wherever they can be mounted.

Passenger Car Frames

The S. A. E. Recommended Practice for Passenger Car Frames was reviewed by the Frames Division at a recent meeting, and it was found that although certain parts of the Recommended Practice are in accord with present practice, much is obsolete. It was decided to circularize the industry for information as to present passenger car frame practice, and the information on the subject in the possession of the Society has been referred to the subdivision. There is now a tendency

toward the use of frames with straight parallel side members, and if the data received indicate a sufficient use of this type, a recommendation for its standardization will be made by the Division.

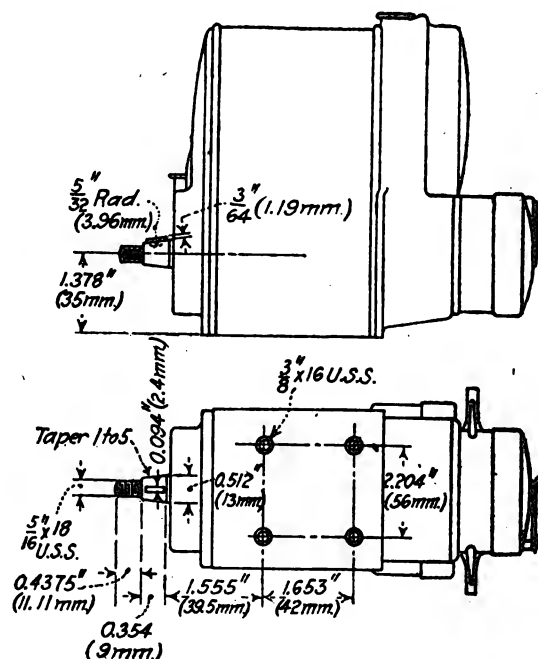


Fig. 2—Preliminary proposal for a standard magneto mounting

The standardization of magneto mountings for stationary engines, isolated electric-lighting plants and small tractors is one of the most important problems before the Electrical Equipment Division. At the meeting held recently in Chicago by the subdivision appointed to formulate a recommendation a preliminary proposal, Fig. 2, was approved. This has been submitted to engine and magneto manufacturers for comment.

The proposal will be considered at the next meeting of the Division.

A Handbook on the Airplane Engine

THE rapid advance in the design of aircraft engines in recent years has rendered handbooks on the subject written previous to the war obsolete. Research work carried out by the aircraft departments of all the belligerent governments added enormously to the stock of practical data bearing on engine design, and the keen competition between designers developed many new features of construction and new operating methods. Much of the information developed is scattered in voluminous and sometimes padded official reports, from which it can be obtained only at great difficulty. Prof. Lionel S. Marks deserves the thanks of the aircraft industry for having written an up-to-date handbook on aircraft engines. In this book, entitled "The Airplane Engine," McGraw-Hill Book Co., the author presents the results of war-time and later developments in this line, together with information of an elementary character on internal combustion engines. Where there is so much material to draw upon as there was in this case, there is always a temptation to use the scissors and pastepot rather freely, which usually results in an unsystematic compilation, and some of the volumes on aircraft subjects which have made their appearance since the war suffer decidedly from this fault. Of Professor Marks' volume it can be said that the material it

contains has been thoroughly digested and arranged in a logical manner, thus forming a very readable and instructive book.

The author states in the preface that his work serves two objects: To formulate existing knowledge of the functioning of the airplane engine and its auxiliaries, and to present and discuss the essential constructive details of those engines whose excellence has resulted in their survival. The first sixty pages are devoted to the general theory of the internal combustion engine. Then in a chapter on Engine Dimensions and Details is given an outline of the different types of engines used for aircraft, and this section of the book contains brief specifications of most of the engines that achieved prominence during the war and since. Next, the author takes up the different component parts of the engine, as well as the various lines of accessories, dealing with each subject in considerable detail. The final chapters of the volume deal with such topics as Supercharging, Geared Propellers, Starting, Manifolds and Mufflers.

The book is well illustrated and contains a wealth of tabular matter, and it should prove helpful to the designer of aircraft engines, as well as to other students of the subject under discussion.

The Use of Alcohol as Fuel in Exported Vehicles

Alcohol is less expensive than gasoline and kerosene in many Central and South American countries, and has been used as a substitute in numerous cases. Several problems which should be considered by automotive exporters are met in its use. Some are discussed and remedies suggested.

By Herbert Chase

THE high price of gasoline and even kerosene in South and Central American countries, the West Indies and some other localities in which there is abundant raw material from which to produce alcohol, but no developed petroleum reserve, has led to a considerable use of alcohol as a motor fuel, and there are reasons to believe that such a fuel will see a wider application in the future, especially in view of the probable advance in the price of all petroleum products. In Cuba and in the Pernambuco district of Brazil, in particular, alcohol has already been extensively used as a motor fuel, and there is a growing interest in this possible substitute for gasoline, especially in sugar-producing communities, where a cheap raw material, which is now a more or less useless by-product of the sugar refineries, but can be converted into alcohol, is already at hand. The low price to which sugar products have recently fallen increases the interest in supplying national needs from local resources, and most of the countries in question are keen, for patriotic and other reasons, to develop these resources and to free themselves from dependence upon imported fuel, which is usually so expensive as to materially curtail the use of passenger cars, trucks and tractors.

Use of Alcohol

Alcohol is in many ways an excellent fuel for automotive purposes, but there are certain drawbacks to its use which can, however, be largely if not wholly overcome by relatively minor changes in design. The purpose of this article is to point out some of the conditions in this regard which must be met, and to suggest means for meeting them, as it is believed that automotive sales to the countries in question can be greatly stimulated by intelligent efforts to accommodate the product to the fuel which is available or will be made available when vehicles intended for its use are in the market. Manufacturers of trucks and tractors, as well as passenger cars, have an excellent possibility of increasing their export business, not only as a result of early sales which are likely to be made possible by the fact that their product is especially suited to the use of fuel alcohol, but due to the good will which such a product would create, both because of the cheaper fuel which it makes available or more readily usable, and because of the fact that patriotic peoples favor the use of products which are adapted to the use of home-produced fuel.

Recent reports from Cuba, collected by *El Automovil Americano* from consular and other sources, indicate that the consumption of fuel alcohol there has reached a total of over 600,000 gallons per month, although this fuel, which retails at 22 to 27 cents per gallon, has to meet the

competition of gasoline at 41 to 46 cents per gallon, a much lower price for the latter than is prevalent in most Central and South American countries, in which gasoline often brings 70 to 90 cents. This is significant as showing the extent to which a native product is employed in the face of competition with a fuel for which the vehicles are primarily designed. The formula for denaturing motor alcohol, known officially in Cuba as "espíritu motor," provides for the addition to 95 per cent alcohol of 10 per cent of gasoline or sulphuric ether and about 1 per cent of other diluents, including formol, piridine and a coloring matter, which distinguishes this fuel from alcohol used for ordinary industrial purposes. However, other alcohol mixtures are permitted and extensively sold.

Cuban Motor Alcohol

Motor alcohol is made from the lower grades of molasses, which now sell at about 2 cents per gallon, and about 2½ gallon of this material is said to be required to make 1 gallon of alcohol. It is thought that it may later prove profitable to manufacture alcohol from the pressed cane fiber (bagasse), which is now largely consumed as fuel for sugar mill furnaces. Under present conditions alcohol is produced to sell in bulk at about 20 cents per gallon, but it is being so extensively used that the producers contemplate early increase in prices.

Reports as to the relative performance of cars using alcohol as compared to those using gasoline vary, but the rapid increase in the consumption of the former indicates that it can be used, at least for a time, with reasonable satisfaction by simply increasing the size of the fuel jet. As will be explained later, cars which use alcohol with only such a change will usually travel fewer miles per gallon of fuel, but there are some reports that the total consumption is not increased. In some cases this may be due to the fact that the gasoline consumption was higher than necessary, had the adjustment of the carburetor been correct.

Under normal conditions the cost of alcohol production in Cuba may be higher than at present, and the price of competing gasoline may also vary, but imported gasoline is now heavily taxed. Gasoline made from imported crude petroleum, refined in Cuba, is not, however, under the same handicap. Nevertheless, because of the appeal to local patriotism which a native product has, it seems quite likely that cars, trucks and tractors which show an equal or better performance on alcohol as compared to gasoline will find a ready market, providing, of course, arrangements for the proper distribution of the native fuel are made. In at least one case an American tractor manufacturer has already found a considerable market for his

product when the latter was equipped with special facilities for economically burning alcohol.

According to reports* dated January, 1922, received from C. R. Cameron, United States Consul at Pernambuco, Brazil, about half the automobiles operating in and about that city were using alcohol as fuel during the first few months of last year. The fuel is described as "42-deg. cane alcohol," to which was added as a denaturant 5 per cent of kerosene, gasoline, benzol, sulphuric ether or castor oil. Some 20,000 gallons of this fuel per month are reported to have been consumed. It is estimated that about 90 per cent of the cars which did employ this fuel have discontinued its use and are again using gasoline, which is considerably more expensive. The following reasons are assigned for the change from alcohol back to gasoline:

1—Fewer miles per gallon. 2—Decrease in power, with consequent difficulties on grades or under heavy loads. 3—Difficulties in starting with engine cold. 4—Solvent or chemical action of the fuel on tanks and fuel lines, with consequent clogging of fuel pipe or carburetor. 5—Rusting and wear of cylinders, ascribed to lack of proper lubrication. 6—Lack of reliable standard fuel which contained varying quantities of diluents. 7—Difficulties of securing a sufficient supply of high-grade fuel on short notice.

Overcoming Difficulties

The report states that it is claimed that all these difficulties are overcome by the use of an engine especially adapted to burn alcohol, the adoption of a standard fuel of approved merit and by giving notice to the producers long enough in advance to enable them to meet the demand. In spite of the difficulties encountered to date, there is still a strong belief that alcohol will be the future automobile fuel, while the Brazilians regard it as a patriotic duty as well as an economy to use the native product. Accordingly, American manufacturers of passenger cars, trucks and tractors which can be adapted to the use of alcohol as fuel are advised to investigate the Pernambuco market. That it is an excellent market for automotive products is demonstrated by the fact that there are now in use in that district at least 1300 passenger cars and 200 trucks, most of which have been acquired since 1919.

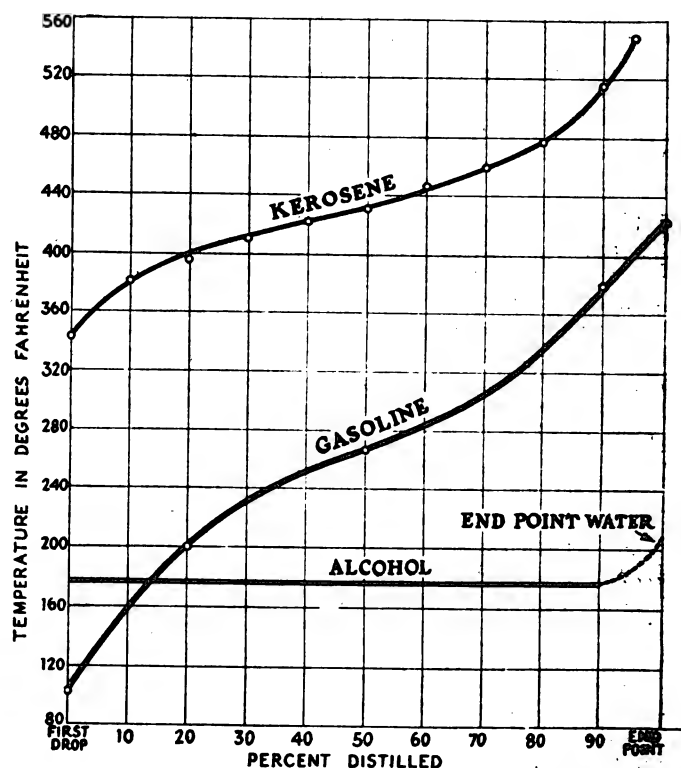
Adapting Vehicles for Use of Alcohol

The difficulties encountered in the use of alcohol as fuel for automotive vehicles in Pernambuco are by no means insurmountable, but are such as might be expected whenever a fuel for which the vehicle is not primarily designed is employed. Alcohol is in some respects a better fuel than gasoline, but it requires somewhat different handling and some relatively minor changes in design and construction to produce the best results. These include, in general: (1) A considerable increase in the compression of the engine, obtainable either by the use of longer pistons, or, better, in the case of an engine with separate head, of a shallower combustion chamber; (2) provision for supplying more heat to vaporize the charge than is ordinarily used; (3) slight changes in carburetor adjustment, and (4) provision for preventing or minimizing the corrosive or solvent action of the fuel on metal and other parts. In some cases special aids to starting may be required unless the diluents used to denature the alcohol are sufficiently volatile to serve this purpose.

Considering, in order, means by which these conditions can be met, we find:

1—Alcohol can be used with a compression ratio of about 6 to 1 without producing detonation, and is, of course, productive of much higher efficiencies when so

used. Gasoline cannot be used with such high compression without violent knocking, hence a larger clearance or compression chamber is required. It is a simple matter, however, to provide for the increased compression by furnishing a special head, and it might in some cases be desirable to furnish two heads, one designed for use with alcohol, and a second which could be applied in case some temporary local condition made it necessary to use gasoline. With the high-compression head it is possible to secure both a higher power and a better economy. The thermal efficiency increases with increase in compression ratio, and it is possible for this reason to secure more miles per



Distillation Curves for Alcohol, Gasoline and Kerosene

gallon of fuel, although alcohol contains less heat units per gallon than gasoline. To accomplish this result involves, of course, a proper carburetor adjustment and other favorable conditions in the preparation of the charge prior to combustion. Unless the compression is raised, the consumption of alcohol will usually be greater than that of gasoline, though the matter of correct carburetor adjustment in both cases may be the controlling factor and account for the conflicting reports as to relative mileage per gallon on the two fuels.

It is entirely possible to secure more power with alcohol than with gasoline even without a higher compression, but the difference will be greater when the compression is raised. The lack of power attributed to the use of alcohol in the report from Pernambuco quoted above may have been due to a variety of reasons, some of them resulting directly or indirectly from alcohol, but not insurmountable or necessarily inherent in alcohol fuel.

2—Alcohol requires more heat for its vaporization than any other of the more common hydrocarbon fuels, but it is completely vaporized at a much lower temperature than is required to vaporize the heavier ends of present-day gasoline and kerosene. On the other hand, it does not contain the volatile ends which are characteristic of gasoline, and, therefore, it is not so easy to start when alcohol is used as fuel as when gasoline is employed. To meet these conditions it is desirable to provide an inlet manifold which is well heated by exhaust gases, and install

*The full report on the subject as applied to Pernambuco can be obtained from the Automotive Division of the U. S. Bureau of Foreign and Domestic Commerce by referring to Exhibit No. 48027.

means for carrying a volatile fuel to be used for starting only, or some type of priming device which provides enough heat to volatilize alcohol in starting when the engine is cold. Once started, sufficient heat can be taken from the exhaust to vaporize the alcohol, providing a properly designed exhaust jacket for the inlet manifold is used. A. W. Scarratt of the Minneapolis Steel & Machinery Corp., which has developed tractors for using alcohol, has secured good results by using an inlet manifold design similar to that employed on kerosene-burning tractor engines.

In case an exhaust-heated manifold would provide more heat than is desirable for operation on gasoline (and gasoline may have to be used at times in localities where fuel alcohol is not uniformly or regularly distributed), it is an easy matter to provide means for shutting off all or a part of the heat. Aids to starting are not always required, especially when the car is to be used in very warm climates or when the denaturant used in the fuel provides the light ends which facilitate starting.

Distillation Curves

One of the curves given in the accompanying chart shows the temperature at which alcohol containing about 5 per cent of water (commercial alcohol contains varying percentages of water) distills. For comparison, similar curves for the average gasoline sold in this country and also that for a representative sample of kerosene are also given.

3—The changes in carbureter adjustment required in changing from gasoline to alcohol involve in general an increase in the size of the fuel jet, or what amounts to substantially the same thing in some carbureters, a decrease in air supply, either of which changes results in the use of a richer mixture. Of course, if the adjustment used for gasoline is excessively rich, as, unfortunately, it is apt to be in some cases, it may be possible to operate on alcohol without a change in adjustment.

4—That fuel alcohol, even when mixed with gasoline or kerosene, has a corrosive action on metals frequently used in the fuel system seems to be a well-established fact. This is attributed to an electrolytic phenomenon, and is apparently most serious in the case of galvanized sheet steel, such as is often used for fuel tanks. In this case particles of zinc are dissolved from the surface and may cause stoppage of fuel lines, carbureter passages and the like. In time the fuel tank will be sufficiently corroded to leak and thus require renewal. Copper is said to be affected to some extent, brass rather less and aluminum little if at all. Some reports regarding lead are to the effect that it is not injured, but tern plate (sheet steel coated with a tin-lead alloy) is said not to give satisfactory results. Steel parts sometimes used in float valves are apt to show corrosion, but brass, monel metal or even high nickel steel alloys can probably be substituted with satisfactory results in most cases, though precise information in this respect is lacking. Tanks of aluminum, lead-coated steel, brass or even copper will probably give satisfactory life in most cases and are certainly much more durable than galvanized iron. Brass is probably better than copper for piping between tank and carbureter, while the brass and bronze parts of carbureters, so far as we have heard, give satisfactory service. Shellac coatings on cork floats are soluble in alcohol, but some other coatings may be satisfactory. In general, however, metal floats are said to be preferable.

So far as we have learned, parts above the carbureter are not seriously affected, although some corrosion of valves and possibly some surfaces of the combustion chamber may occasionally occur. This may be due to the presence of acetic acid in the products of combustion, a

fact which may also account for the muffler rusting out in one or two cases which have been reported. Such trouble is probably not serious in many cases, especially as the parts affected are not usually expensive and can be readily replaced.

On the whole, it is probably neither difficult nor expensive to make the slight changes in construction desirable to prevent any serious trouble from the corrosive action of alcohol. The freedom from carbon deposit in the cylinders, which is characteristic when alcohol is used as fuel, will probably more than offset any slight difficulties which may result from corrosion when the materials suggested are employed.

Trouble, which may in some cases result from a lack of uniformity in the alcohol fuel employed in various localities, cannot always be guarded against, but will probably not often occur if the changes referred to in respect to equipment are made. It may well be that some of the troubles laid to lack of uniformity in fuel are due rather to the cumulative effect of corrosion causing stoppage of fuel lines and the like than to actual variation in fuel quality. On the other hand, it is well to remember that alcohol and water are readily miscible, while gasoline and water are not, so that unreliable vendors may cause some trouble by diluting fuel with water, although a moderate amount of such a diluent may have no ill effect. Nearly all commercial alcohol contains 5 per cent or more of water. Other ordinary diluents, such as benzol, gasoline, kerosene and sulphuric ether, will probably not have ill effects unless the proportion used is excessive, and this is not likely, since they are apt to be more expensive than the alcohol itself.

There is a possibility of trouble from the use of castor oil, which is reported to be one of the denaturing agents used in Pernambuco, as this is relatively non-volatile and is apt to form a leathery carbon deposit. It may also form an emulsion which would cause trouble in the fuel system. Rusting and wear of cylinders referred to in the Pernambuco report and attributed to insufficient lubrication may be due in part to inadequate oiling, but the formation of rust is more likely due to the presence of acetic acid in the products of combustion, which would probably not do any serious injury to wearing parts, except perhaps if the car is allowed to stand idle for long periods after running on alcohol.

Conclusion

From the foregoing it will be apparent that the use of alcohol as automotive fuel is not without certain drawbacks, but that most if not all of these can be overcome or are not serious, providing reasonable precautions are observed and the vehicle properly adjusted and adapted to the conditions to be encountered. Some experimental and development work will be required in most cases, but the manufacturer who seriously and intelligently tackles the problem should in the end profit accordingly.

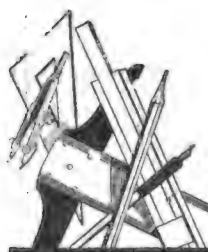
RESEARCH work looking to the production of a national motor fuel is being continued in France under the auspices of the "Scientific Committee." The work has been assigned to sub-committees and is being carried on at the National Powder Factory, at the College of Arts and Trades, at the National Agricultural College in Douay and at private laboratories. The Minister of Agriculture has placed 50,000 francs at the disposal of the Douay school and the Minister of Finance has contributed 400,000 francs to a research fund and 500 hecto-liters (12,500 gal.) of alcohol for the experiments. The use of alcohol for the motor bus service in Paris is being continued, the daily consumption being in the neighborhood of 8500 gal.

Exports of Passenger Cars, Trucks, Tires, Tractors,

COUNTRIES	GASOLINE PASSENGER CARS						GASOLINE TRUCKS						PARTS		ELECTRIC PASSENGER CARS AND TRUCKS	
	Up to \$800		\$800 to \$2000		\$2000 and over		1-ton inc.		Over 1 to 2½-ton		Over 2½ tons					
	No.	Value	No.	Value	No.	Value	No.	Value	No.	Value	No.	Value	Value	No.	Value	
Europe																
Austria.....																\$105
Azores and Madeira Islands.....																1,651
Belgium.....	111	\$52,148	9	\$9,042					19	\$8,193						6,243
Denmark.....			21	20,193					1	1,000						37,064
Far Eastern Republic.....																
Finland.....					1	\$5,000										
France.....	2	750	3	2,808	2	10,500										56,258
Germany.....					1	3,000										75
Gibraltar.....																1,339
Greece.....																
Iceland and Faroe Islands.....																461
Italy.....			1	1,465	1	10,309										4,564
Malta, Gozo, and Cyprus Islands.....					1	3,000										27
Netherlands.....	29	15,217	9	9,647			42	\$21,607								6,892
Norway.....	3	2,224	13	11,200												3,793
Poland and Danzig.....																665
Portugal.....																80
Roumania.....																716
Spain.....	4	1,245	21	23,031	5	12,122	1	1,116	1	1,100						31,638
Sweden.....	14	7,978	29	29,282			1	396							6	\$8,750
Switzerland.....					1	3,000										2,306
Turkey in Europe.....	10	3,258							2	734						1,832
England.....	2	1,583	22	23,519	1	2,100			1	2,014						342,661
Scotland.....			4	3,628	1	2,500										407
Ireland.....	1	350														6,622
Yugoslavia, Albania, etc.....																1,045
North and South America																
Bermuda.....																44
British Honduras.....																212
Canada.....	60	35,878	126	146,198	39	133,895	2	1,245	32	34,374	8	\$18,738	987,619			1,913
Costa Rica.....			4	3,232			1	500	2	2,424						2,450
Guatemala.....	6	4,800	5	5,329	2	4,641			2	2,600						3,677
Honduras.....											1	3,800				220
Nicaragua.....																8,910
Panama.....	6	2,840	7	9,434			6	2,597								2,669
Salvador.....									1	3,220						93,237
Mexico.....	269	112,452	69	75,683	5	11,759	55	22,545	18	28,738	2	7,059		5	3,300	
Newfoundland and Labrador.....			1	1,498												708
Barbados.....																976
Jamaica.....	28	12,530	9	10,376	2	7,000	3	1,286								7,597
Trinidad and Tobago.....	3	1,234	5	4,236			12	5,097	1	1,530						3,836
Other British West Indies.....	6	2,331	3	3,603	1	5,065			1	1,700						3,625
Cuba.....	19	8,515	12	13,324	4	12,500	4	1,423	1	500	2	6,960	26,927			918
Virgin Islands of U. S.....																2,129
Dutch West Indies.....	2	745					2	861								855
French West Indies.....																4,654
Haiti.....	2	1,300	2	1,616												93,204
Dominican Republic.....	2	882														104
Argentina.....	4	2,940	33	38,295	2	6,000			1	1,500						8,955
Bolivia.....			36	35,291	1	2,110										4,509
Brazil.....			1	975												5,803
Chile.....																2,354
Colombia.....	3	1,167	1	1,034			2	710	1	934	1	5,700		1	575	
Ecuador.....																1,169
British Guiana.....	3	1,306														71
Dutch Guiana.....																
French Guiana.....	1	610														89
Paraguay.....			2	2,818	1	3,000										5,960
Peru.....	1	310	9	9,204			10	2,654			1	4,805				4,443
Uruguay.....	2	1,456														4,781
Venezuela.....	51	23,233	5	4,590	1	6,000										
Asia																
Aden.....			1	1,108												315
Algeria and Tunis.....																
Armenia and Kurdistan.....	30	11,331	8													469
Ceylon.....	4	2,333														10,076
China.....	29	15,341	19	18,810	1	2,200			2	5,115	1	1,516		2	1,608	
Kwantung, leased territory.....			3	2,940												828
Chosen.....														10	22,680	
British India.....	21	15,205	52	46,964	2	8,365	2	2,198	25	28,547						23,692
Straits Settlements.....			7	7,164												4,207
Other British East Indies.....			6	5,505												8,709
Other Dutch East Indies.....																763
French Indo China.....																2,239
Hejaz, Arabia, Mesopotamia.....																1,329
Hongkong.....			3	3,042												29,146
Japan.....	103	41,125	3	2,921	1	4,157	51	24,788	11	32,887				1	3,776	
Java and Madura.....	9	3,000	19	22,788	2	5,700										13,519
Palestine and Syria.....	10	3,777	8	6,932			1	515	2	2,226						10,258
Persia.....																
Siam.....					1	5,000	1	1,400								254
Turkey in Asia.....	6	2,266														101
Australia.....	382	256,570	249	272,818	3	7,707	12	15,078	92	121,205	5	8,017				71,282
New Zealand.....	17	10,388	78	72,229					3	5,310	1	3,000				31,928
Other British Oceania.....	3	1,491														85
French Oceania.....																
Other Oceania.....																388
Philippine Islands.....	1	443	15	18,867												9,399
Africa																
British West Africa.....	3	1,306	5	4,688			5	2,123	1	1,680						10,763
British South Africa.....			47	51,075												13,476
British East Africa.....																70
Canary Islands.....	1	520	9	10,983	1	2,400	2	2,868								1,889
French Africa.....	4	1,447														2,079
Morocco.....																3,583
Portuguese Africa.....	2	890														1,267
Portuguese East Africa.....																733
Egypt.....	61	24,221					7	3,060								4,562
Total.....	1,330	\$691,065	994	\$1,055,879	83	\$279,030	222	\$114,067	220	\$287,531	22	\$50,595	\$2,060,619	26	\$41,135	

Motorcycles and Aircraft for January, 1922.

TIRES						FARM TRACTORS		PARTS	MOTORCYCLES		AIRPLANES AND SEA-PLANES		PARTS	COUNTRIES
Casings		Inner		Solid		No.	Value	Value	No.	Value	No.	Value	Value	
No.	Value	No.	Value	No.	Value	No.	Value	Value	No.	Value	No.	Value	Value	
Europe														
100	\$1,505							\$6,149	88	\$21,812			\$2,207	Austria
915	24,818	1,296	\$4,537	110	\$3,090			136	106	30,760				Azores and Madeira Islands
60	810	50	150											Belgium
														Denmark
820	10,660	614	2,537	8	355	54	\$21,481	2,534						Far Eastern Republic
														Finland
														France
														Germany
														Gibraltar
														Greece
														Iceland and Faroe Islands
														Italy
														Malta, Gozo, and Cyprus Islands
														Netherlands
														Norway
														Poland and Danzig
														Portugal
														Roumania
														Spain
														Sweden
														Switzerland
														Turkey in Europe
														England
														Scotland
														Ireland
														Yugoslavia, Albania, etc.
North and South America														
														Bermuda
														British Honduras
														Canada
														Costa Rica
														Guatemala
														Honduras
														Nicaragua
														Panama
														Salvador
														Mexico
														Newfoundland and Labrador
														Barbados
														Jamaica
														Trinidad and Tobago
														Other British West Indies
														Cuba
														Virgin Islands of U. S.
														Dutch West Indies
														French West Indies
														Haiti
														Dominican Republic
														Argentina
														Bolivia
														Brazil
														Chile
														Colombia
														Ecuador
														British Guiana
														Dutch Guiana
														French Guiana
														Paraguay
														Peru
														Uruguay
														Venezuela
Asia														
														Aden
														Algeria and Tunis
														Armenia and Kurdistan
														Ceylon
														China
														Kwantung, leased territory
														Chosen
														British India
														Straits Settlements
														Other British East Indies
														Other Dutch East Indies
														French Indo China
														Hejaz, Arabia, Mesopotamia
														Hongkong
														Japan
														Java and Madura
														Palestine and Syria
														Persia
														Siam
														Turkey in Asia
														Australia
														New Zealand
														Other British Oceania
														French Oceania
														Other Oceania
														Philippine Islands
Africa														
														British West Africa
														British South Africa
														British East Africa
														Canary Islands
														French Africa
														Morocco
														Portuguese Africa
														Portuguese East Africa
														Egypt
														Total
\$80,511	\$1,148,016	48,935	\$116,385	3,800	\$147,500	382	\$220,877	\$98,902	1,010	\$284,883	1	\$5,000	\$11,479	



The FORUM



Calcium Chloride Non-Freezing Solutions

Editor, AUTOMOTIVE INDUSTRIES:

I was particularly interested in your editorial entitled "The Year-Around Chassis" in the issue of Feb. 23, 1922, because it appeared so soon following the completion of a long series of tests for the purpose of developing a non-corrosive anti-freeze compound.

The investigation soon narrowed down to compounds in which calcium chloride was the principal ingredient. Other inorganic compounds do not produce the desired lowering of the freezing point; and substances such as alcohol, glycerine, kerosene and xylene were discarded on account of inflammability or high cost. The work was highly gratifying in that it developed a calcium chloride compound which had no corrosive action on steel, cast iron, copper, brass or solder, and but very slight action on pieces of brass and copper soldered together with a relatively large exposed area of solder.

In the course of this work, the compounds available on the market received comparative tests. While almost all of these compounds are put out by concerns of good repute, their corrosive action on soldered brass and copper was far from satisfactory. In every case the metal in close proximity to the solder, and particularly the solder itself, showed severe attack. Chemical analysis of the compounds seemed to indicate that their development must have been a "hit-or-miss" proposition, with no proper consideration for the factors involved.

The best commercial calcium chloride obtainable to-day in large quantities is slightly alkaline in action and contains about 1.5 per cent sodium chloride with less than 0.5 per cent of inert insoluble matter. It is well known that sodium, ammonium and magnesium salts present in calcium chloride brine will increase to a large degree the corrosive rate. Why, then, should one compound to-day on the market contain a sodium salt which reacts with calcium chloride to form an almost insoluble calcium compound with corresponding increase of the sodium chloride content? A test made adding the complementary radicle of the sodium salt combined with calcium instead of with sodium showed less than half the corrosion of the original.

The problem is essentially one of reducing not only chemical but electrolytic corrosion. The first depends on temperature, concentration and dissociation; the second, all of these, with the addition of the factor of electric conductivity. Since it may be assumed that the corrosive action of calcium chloride solutions is due to the concentration of chloride and hydroxyl ions; then the logical step is to add some substance which, without being harmful in itself, will decrease the dissociated portion or the active portion of the chloride and hydroxide present. In the case of the calcium compounds this is simple, but with sodium considerable study and tests are involved. A prepared sample of sodium-free calcium chloride, to which was added a substance which greatly decreased its dissociation, exhibited an almost inappreciable corrosion.

The factor of temperature is obviously not subject to control in the case of radiator compounds; and the con-

centration is fixed by the desired freezing point. The electric conductivity can be very much reduced, however, by the addition of organic agents which are well known to every electrochemist.

A point I wish to emphasize is the desirability of keeping the metal surface of the radiator free from films or deposits of insoluble matter. In this connection, one compound examined produced in a very short time a deposit which was nowhere less than .002 inch in thickness. From the thermal conductivity of the deposited substance, it was calculated that in a radiator made of .009-inch gage copper, the cooling efficiency would be reduced in the ratio of 80 to 1! A radiator is placed on a chassis for a definite purpose, and this purpose should never be forgotten. Protection of the radiator by coating the metal with an insoluble film is not logical and will not be successful.

To summarize, a calcium chloride compound for radiator use should contain ingredients: (1) To greatly reduce the dissociation of chloride and hydroxides, (2) to decrease as much as possible the electric conductivity of the solution, (3) which preferably form insoluble compounds (if any) with all the metals in question, but not with calcium, (4) which will not result in decreased cooling efficiency by deposits of scale or any insoluble matter, (5) which are not of such nature as to spoil perfectly good paint jobs in case the radiator is allowed to boil over, and finally, (6) the calcium chloride used should be of the highest quality commercially obtainable.

N. JULIEN THOMPSON,
Development Engineer, Stamford Rolling Mills Co.

Stability of Four-Wheel Drive Tractors

Editor, AUTOMOTIVE INDUSTRIES:

In your publication of March 9, 1922, in the second sentence on the article on page 554, I wish to call your attention to an error, as under the design of tractor indicated the tendency to rearing is not eliminated, it seems to me, for the reason that if the driving torque were sufficient to raise the front end of the tractor, such action would not relieve the torque from the back wheels because the front wheels are positively chained to the back ones, and if the front wheels were in the air they would merely be acting as a countershaft for the back ones and the tractor would be essentially a rear driving machine. I will be interested to know if your writer agrees with me in this understanding.

H. W. RILEY.

We agree that if the weight distribution in the four-wheel drive tractor is the same as that in the two-wheel drive tractor, the tendency to rear will be the same in both. But there is no reason why the weight distribution should be the same. We have a parallel case in the four-wheel drive truck, and it is well known that there is always much more weight on the front axle of such a truck than on that of a two-wheel drive truck of the same total weight.

In a rear wheel drive tractor, as only the weight on the rear wheels is effective in giving traction, designers place

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THE AUTOMOBILE

as much of the weight as they dare on the rear axle. The small amount (about 10 per cent) remaining on the front wheels when the tractor is pulling a full load, is necessary for surety of steering under these conditions. The tendency to rear increases as the distance from the rear axle to the center of gravity decreases. In a rear wheel driven tractor the center of gravity must be kept close to the rear axle for the above reason, while in a four wheel drive tractor there is no such restriction on its location and it would be placed farther ahead. In such a tractor it is evidently desirable to have the front wheels carry considerably more than half of the total weight when the tractor is at rest.

With the same weight distribution there does not seem to be any difference in the tendency to rear as between a two wheel and a four wheel driven tractor. Let us consider the two wheel drive tractor. At the moment the front wheels leave the ground all of the weight originally on the front axle has been shifted to the rear axle. Now, torque on the front axle has exactly the same effect in transferring weight as torque on the rear axle. Evidently any less combined torque in the four wheel drive tractor than that which caused the rearing in the two wheel drive tractor would not move the machine, and as soon as the combined torque reached this value all of the weight would have been transferred to the rear axle and the tractor would rear.—EDITOR.

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Positive Steering Mechanism for Track Laying Vehicles

Editor, AUTOMOTIVE INDUSTRIES:

Mr. Darnell, in the March 2 issue of AUTOMOTIVE INDUSTRIES, says he believes that the power required for handling the steering gear suggested by me in the Jan. 26 issue will be considerable, and that the speed of the steering worm for short turning will be inconveniently great.

I wish to say, that these suppositions are contradictory; furthermore, the only resistance in steering is constituted by the friction inside differential box 2, and the small secondary friction in the steering-gear train, caused by the primary steering friction inside differential box 2. It is an easy matter to calculate the steering resistance for a given machine, and it will then appear that this resistance compares very favorably with the power required for declutching and braking in present day "steering" mechanisms for track laying vehicles.

It is obvious that this eliminates the possibility of the speed of the steering worm for short turns being excessive.

It is quite unnecessary to use friction disks or any kind of "servomoteur," and the mechanism, therefore, not only looks very simple, but it is simple.

As I did not ask a patent for this construction, it may be used by any one.

H. C. OLIVIER, A.S.A.E.,
Holland.

Paint Standardization

Editor, AUTOMOTIVE INDUSTRIES:

Referring to your letter of March 17 outlining Mr. Franklin's idea of standardizing automobile painting materials, also your query as to what method of specification would be the best and most effective, chemical properties or physical properties:

It has been thoroughly demonstrated in the past that specifying chemical properties does not, by any means, insure a uniform varnish. This is due to the fact that no matter what raw materials are used, the quality and uniformity of the varnish is also dependent upon many

other factors, such as temperature at which varnish is cooked, atmospheric conditions and the human factor.

Broadly speaking, any two varnish makers using the same formula and raw materials will produce two varnishes that will differ largely in physical characteristics.

The Government has recognized this fact, and their specifications as now issued, are based on a list of physical tests, which have been adopted after extensive experiments both by the Government's laboratory and the varnish manufacturers, both co-operating to obtain efficient and positive method of determining the quality of any varnish.

N. J. FAGAN,
Superintendent, Hildreth Varnish Co.

Paint Standards Desirable

Editor, AUTOMOTIVE INDUSTRIES:

The suggestion that the Society of Automotive Engineers take steps toward standardizing automobile painting materials and operations will doubtless be of value if properly followed out, with the co-operation of the manufacturers of these materials, although it will be a long time before definite standards can be laid down.

The first thing to be done, and the one which will take the longest time, is to establish as nearly uniform conditions of operation as possible, for all standardization of materials must be based upon operating conditions. Whether such uniformity can ever be satisfactorily attained is a question, for the factors affecting these operating conditions are so many that it will not be easy to control them in such a way as to bring about the introduction of uniform schedules. A commercial job of automobile finishing may be produced with a quality satisfactory in the minds of some, for a low priced car, with three coats of material, applied by flowing, while others consider that the only satisfactory finish requires ten or a dozen coats. Some plants are equipped for handling the majority of their materials by the spray process, while others have no such equipment. Some can bake; others must air dry. A further difficulty arises from the fact that necessary differences in pigment composition, due to the different colors demanded, cause differences in the working and drying properties of the japan colors or enamels used. The more one considers the complexity of the situation, the more stupendous the problem of standardization becomes.

With relation to the basis of standardization, we stand without question for a reference to physical properties, rather than to chemical formula. The production of finishing materials is an art which is in a state of constant improvement. New materials are becoming available, which in many cases are superior to those formerly used, and of these some are becoming extinct. The setting of a chemical formula standard would discourage further efforts at improvement, and would make it impossible for a manufacturer to supply a composition of different formula, which had been proved by thorough test to produce better results at lower cost than the one specified. On the other hand, if the standard established is based on the fulfillment of definite physical properties corresponding with what is actually required of the goods in use, improvement can readily be made.

More than one-half of the net success in use of any finishing material is due to its proper application and treatment in the hands of the user, and in issuing S.A.E. ratings, upon which a job shop could depend, this fact cannot be too strongly emphasized.

C. R. BRAGDON,
Chemical Director, The Ault & Wiborg Co., Varnish Works.

Methods More Important Than Figures in Marketing Plans

Correct basic statistics are essential to proper marketing plans. Difference in efficiency between the plans of various manufacturers, however, lies rather in the methods applied to the use of statistics than in variation in the statistics themselves. Relative efficiency of these methods discussed.

By Harry Tipper

THE individual manufacturer, considering carefully the methods to be used in his marketing of his product, finds it difficult to assure himself on many of the basic figures required for his operations. If the tendency of registrations is to be considered in estimating the probable future market, then the tendency must be calculated from accurate sources and the tendency determined from accurate methods of calculation. The same thing is true of production. The matter becomes a little more difficult when the study is extended to take in the conditions involved in the various territories and, consequently, the individual tendency of business in each territory in relation to any price group or any group of products.

The great difference in the efficiency of marketing plans, however, arises not so much from miscalculation based upon erroneous basic figures, but rather from the methods by which the market is to be reached and the variation in the efficiency of these methods.

The manufacturer may have a very excellent picture of the tendency of car registration, the tendency of car production, the condition of the business in the various territories, the growth of closed-car models, the relation between the new car and the used car in the market, and other items dealing with the general economic status. These are valuable, however, only as they point the way to accurate methods of reaching the market and maintaining it. This manufacturer may neglect the dealer, or put the weight of his pressure upon the wrong portions of the territory. He may put the extensive sales pressure or a competitive effect where the basic facts would indicate that this effort should be lessened, and, in fact, the success of his plan will depend almost entirely upon the way in which his basic facts are used to work out his plans in accordance with the things which they suggest.

In the last article which appeared in AUTOMOTIVE INDUSTRIES of March 23, the probable market for the manufacturer was indicated in an example given at the end of the article. This probable market was divided into the states by a further example and this article proposes to take up the matter from that point, showing how the manufacturer should use this information in relation to his plans of action.

The car manufacturers mentioned in March 23 article had a prospective market, arguing from past experiences, of a certain number of cars within their price group. The object in front of these manufacturers in making their marketing plans for the year is to accomplish this sale with the least cost per car and, at the same time, build

the distributing elements into the skeleton of permanency as much as possible. Manufacturer "B" had a market probability of 2690 cars for 1923. His cars at present are being sold by five distributors through 250 dealers, mainly in the large cities and towns of 100,000 or over. Certain circumstances must enter into the plans at this stage in order to apply the basic figures of market differences to the particular case of this manufacturer's operations for 1923. So far the manufacturer has determined the following:

1. The percentage within his price group is four per cent. The total number of cars to be sold in his price group in 1923 is 72,000.
2. On the basis of a total new production of 1,800,000 for the whole industry.
3. Car manufacturer "B" has discovered that these figures, in comparison with his past activity, give him a market probability of 2690 cars.
4. Car manufacturer "B" has also figured each State in regard to its proportion of the 2690 cars and, consequently, whether the State is growing in activity or decreasing.

With this information before him, it is necessary for this car manufacturer to make certain decisions upon his sales work, his advertising work, his methods of distribution, etc. In order to do this, however, further information is necessary to bring these broad facts down to the unit of merchandising operation. The manufacturer must decide:

1. Whether he will continue to sell other distributors or deal direct with dealers.
2. What type of a dealer he desires to secure.
3. How he will lessen the mortality in his distribution.
4. What efforts he will make to maintain a full line of distribution, whether he will extend his present distributing area or intensify on the present area.

In order to make these decisions intelligently he must add to this accumulation of information a further knowledge on these points:

First—The relative efficiency of distributors and his own branches for his own particular business, considering its size and its position within the price group.

Second—The mortality in the dealer field, the number of changes to be expected in the functions of dealers, the number of new connections he must make in order to keep his distributing intact, the distribution of the car populations in his price group as between rural and urban, and as between large and small cities; the distribution of the dealer population available for his purposes, and the distribution of his present outlets in relation to the general field.

These facts are just as important to a reasonable development as the more general economic facts previously considered. They are not quite so easy to secure, however, and are subject to a larger degree of possible error than the registrations and production, all of which can be determined closely. The relative merits of distributors and branch representatives depend so much upon the personal equation in the particular considerations of an organization that there can be no standards of examination fitting the general situation closely enough to be of great value to the individual manufacturer.

Similarly, the number of dealers coming into and going out of the field within a year is variously estimated at figures so widely apart as to be useless unless they are further examined. Of course, the same thing is true as to the number of dealers in the field at any given time. Various sources of information will present figures so widely separated as to be useless unless they are verified by some establishment of standards or reasons.

The same difficulty surrounds all proper accumulation of information regarding the distribution of cars of any price group in town and cities of various sizes, and the relation between these elements of the business and the manufacturer's distribution. Discussions on these points will require, consequently, a larger development than is possible in this article, and most of these factors will be considered separately in succeeding articles so that they may be determined more definitely in their relation to the economic status in the field. It is possible, however, to consider the question of what is a dealer at this point as this question almost governs all the rest of the calculations to be made by the manufacturer if his marketing plans are to be properly based.

The automotive business, as we have pointed out in these articles, is the first industry for the manufacture of complicated machinery and the sale of it through dealers to the general public. Sewing machines, typewriters, washing machines, etc., are very simple in comparison and they do not run to the volume. As a consequence of this, the dealer is not retailing goods over the counter only. He is keeping the car running and doing a good many jobs required in that connection. A list of all the people who buy anything to resell in this business, who do service

in any way, who repair or who buy at the dealer's discount, would run probably close to 150,000 but a large number of these could not be considered as dealers in any ordinary sense of the term as it is understood by the manufacturer securing distribution in this field.

The word "dealer" is a misnomer, anyway, as a term used to cover the multifarious activities required in keeping the car and the truck running on their way to the junk pile. These dealers should be classified and grouped into subdivisions before there is any real possibility of understanding their value, and some minimums should be set up which must be met before a man can be classified as a dealer so that the thousands of concerns who get a dealer's discount but buy only for themselves and thousands of others who sell a very limited number of accessories, etc., can be rightly placed and rightly estimated in any consideration of the matter.

Most of these should be eliminated entirely, and the list of dealers will be valuable to the manufacturer only as he knows:

First—What are the standards required to get on the list.

Second—How are the subdivisions arranged, and,

Third—What are the methods of keeping up with the changes.

When the number of dealers in this field is variously estimated at from 70,000 to 140,000, the basis for estimating offers no real security to the manufacturer unless he analyzes the list very definitely in relation to the basis so that their value to him may be determined carefully and thoroughly. The dealer establishment, as we conceive it, is an establishment devoted entirely to be the distribution and maintenance of automotive products at retail for the owners and buyers of such product. This dealer establishment must keep a stock and equipment, a place of business, a line of custom, and some kind of credit in order to be classified in this way.

In all the further analyses on planning for the market, the dealer will be determined from this standpoint, and any figures considered as to the number of dealers or the mortality among dealers will be based upon that standard requirement.

The Perpetual Inventory

THE perpetual inventory, or stores control system, is strongly urged by the Fabricated Production Department of the Chamber of Commerce of the United States as a better method in manufacturing establishments than the annual physical inventory, with its general disorganization and shutting down of the plant.

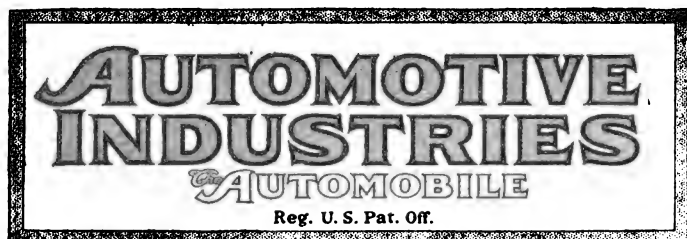
A practical pamphlet on the subject, which has just been issued under the title of "Perpetual Inventory or Stores Control," goes at length into the advantages of perpetual inventory and carries a series of illustrative forms. Doing away with the annual inventory of materials is only one of a number of benefits derived from the system as set forth by the department.

"The perpetual inventory test is an important link in a chain that makes less frequently necessary the burdensome and often inaccurate annual physical inventory. The annual physical inventory entails a general dislocation of plant and frequently a shut down lasting as long as three to seven days; and the results are not dependable. Hence

the desirability of eliminating the annual physical inventory as far as possible.

"This is accomplished by independent checking of the material indicated as on hand on the perpetual inventory and bin tag records through a physical count of selected items of stores, and noting and correcting any discrepancies between stock actually on hand and the quantity shown by the bin tag and perpetual inventory records. These inventory tests are made periodically and systematically, preferably at times when the material selected is lowest, and the attempt is made to cover each item of supply at least once a year and important items oftener. It is possible by these tests, as supplementary to the bin tag and perpetual inventory records, to secure an accurate count of material without the burdensome annual inventory."

Copies of the pamphlet may be had in limited quantities free of charge from the Chamber of Commerce of the United States, Mills Building, Washington, D. C.



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Aviation Control Necessary

NOTHING more seriously demonstrates the necessity for Federal control of civil aviation than the hydroairplane accident on the route from Miami, Fla., to Bimini recently when five passengers were drowned due to breaking of a propeller when perhaps not 10 miles from land. The plane was operated by a pilot who presumably owned the plane and operated it as an aerial jitney. It was a single engine plane and he did not carry a mechanic and apparently had no signal system, such as is used by day or night. It is reported that a storm was predicted and the pilot should not have started on the 45-mile hop from Miami to Bimini.

The Aeromarine Airways, which operates a hydro-airplane service from Miami to Bimini 45 miles and Nassau 187 miles and Havana 250 miles, and also from Key West to Havana 100 miles, uses two engines on each of its boats with capacity for 11 passengers, carries two pilots and two mechanics. They are equipped with distress signals for day or night and never leave on any trip without a weather report from

the point of destination. The Aeromarine had 30 boats in service and since its start two years ago has never lost a passenger. It uses single-engine planes for sightseeing along the Florida coast, but not for cross-sea hops.

Aerial navigation should be regulated so that passengers are assured every protection by way of all safeguards that marine or land navigation calls for. A few accidents such as the recent one will work serious injury to the development of aerial transport. Accidents will give the plane a set-back similar to that suffered by airships due to the Roma and Z R 2 disasters.

Cooperation

THE proprietors of a suburban garage were asked whether they did not contemplate taking the agency for a car. They replied, "We inherited the agency for the Sennett when we took over the garage. We sold several, but the manufacturer maintained the position that as soon as we took the cars off his hands he was through with them and, as a result, servicing the cars as they had to be serviced the first few months ate up all the selling profit and we discontinued the agency."

Something is dead wrong. These brothers are usually well educated, keen men. They have made a reputation for themselves in the community for being honest automobile men, and as a result have secured a fast growing, stable clientèle. The car which they handled was a well-known low-priced one which would sell well in that locality, but the sales are all going to a competitor who backs his dealer.

If manufacturers will not realize the responsibility that retailing a car through a dealer entails he can never hope to have the loyal dealer organization so essential to success. When dealers understand the fundamental value of service they should be given every incentive to practice what they believe. It is only by such procedure that the manufacturer is going to attain the permanency of market which is so valuable.

The Cart Before the Horse

THE adjustment of sales quotas to absorb a predetermined production program has always been a more or less hit-or-miss proposition. It may be likened to putting the cart before the horse. The results secured are similarly awkward and equally uncertain. Both impede steady movement.

From time to time articles have appeared, and will continue to appear, in AUTOMOTIVE INDUSTRIES giving facts which show how essential it is to know the market and plan production accordingly. In these articles, manufacturers are given the benefits of research on a comparatively unknown subject, that of distribution with relation to production.

Until recently it has not been necessary to adjust production to market possibilities. As long as production was only limited by the ability to produce the common method was adequate. Recently the horse has slipped around behind the cart without our full

appreciation of the fact. It becomes vitally important to forget the method which places production as the prime factor and adjust the latter according to the market consumption.

Diesel Engine Development

CONSIDERABLE interest has been aroused in automotive circles by the work done by Sperry and others in attempting to reduce the weight of Diesel engines and to adopt them to construction in smaller units. When the Hvid engine appeared on the market some years ago it was felt that the Diesel principle had reached a state of development such that its introduction for automotive purposes was imminent, and the frequency of discussions on Diesel engines before the S. A. E. in recent years lends support to this view. But the distance from even the submarine type of engine—undoubtedly the most refined and developed up to the period of the war—to a practical road vehicle engine is a long one, and it will no doubt take a good many years more before the Diesel type of automotive engine is applied commercially to any large extent. Nevertheless, automotive engineers are keenly interested in any progress in the movement to make these engines lighter and more flexible.

It is natural that, since the Diesel engine is now being successfully used for marine propulsion, any smaller and lighter types developed should see their first application to motor boat work. In the marine field high operating speeds and consequent light weight are not so essential as in the automobile line, and lack of flexibility is not such a serious handicap. In this particular field, moreover, there seems to be a demand for engines of all outputs from those of several thousand horsepower down to the small outboard motors used on rowboats, and the size of the engine can be reduced step by step and the manufacturer be assured of a market for any size he may put out if it is otherwise of merit and can meet competitive prices.

Showing pictures of simple Diesel engines of low speed alongside of compound engine and claiming the difference in weight and bulk to be due to the compounding, may, however, give a wrong impression. One can imagine the compounding of an automobile type of Otto engine and then comparing it with a simple Otto engine. These engines are being built in small output, stationary types weighing several hundred pounds per horsepower, while simple Otto engines for aircraft work have been built weighing less than 2 lb. per hp. It will thus be seen that there are other factors influencing the weight—and incidentally the bulk—of internal combustion engines besides the splitting up of the expansion between two cylinders.

During the war a great deal of experience with Diesel engines was gained in all the large industrial countries, and it is little wonder that the firms engaged in this line of work are now seeking to enlarge the field of usefulness of that engine. Peculiarly enough, the Diesel engine seems to be limited as to size at both ends of the scale. It has been found that when a certain size of cylinder is reached further in-

crease is practically impossible because of the difficulty of maintaining the working parts at suitable temperatures. At the lower end of the scale it is rather the comparatively high weight in proportion to output that is holding back further commercial development. That these limitations are gradually being overcome is shown by the results of Sperry's work and is also indicated by a report to the effect that a well-known British engineering firm is building a Diesel engine to weigh not over 5½ lb. per hp.

Distributors and Factory Branches

INVESTIGATION does not bear out the rumor, recently current, that many manufacturers are intent upon the elimination of the distributor and the installation of factory branches. While a certain number of factory branches are operated by manufacturers, there is no real tendency to operate entirely on this basis. Whatever trend there is appears to be in the opposite direction.

The composite opinion of about ten representative companies on this subject may be summarized about as follows: "We have no intention whatever of eliminating distributors and of substituting factory branches. In certain cases it may be impossible to obtain suitable representation in a given territory and a factory branch may be necessary. This is a matter of self-defense, however, rather than of desire to eliminate the distributor. We will never disturb a good distributor."

Certain factors of cost are sometimes neglected in discussing the relative economic merits of the two plans. The advantage of the initiative and ability of the man in business for himself as opposed to the man on salary, for example, has an important bearing.

Tribute

THE following sentences which appeared in a recent copy of a London newspaper may well be given a few moments' notice by American manufacturers:

"Motorists have a good deal for which to thank the American car manufacturer. For instance, the importation of transatlantic cars in relatively large numbers in recent years has had a marked effect on the value which our producers are offering to the motorist. Another lesson to which we would do well to pay careful attention is the interchangeability of parts in American cars and their supply, together with general chassis accessibility. Much improvement has recently been made here."

The feeling of self-satisfaction which may be enjoyed will probably be followed by a realization that the British manufacturer is also reducing prices and that the appreciation of our engineering features is likely to result in pursuit along the same lines. In other words, competition is going to be met more and more. Continued success of the American low-priced car in the export field means that we must always keep two jumps ahead.

March Biggest Month in Two Years

Carload Shipments Approximate 25,000

**This Mark Has Been Equalled
Only Three Times in Last
26 Months**

NEW YORK, April 4—March was the best month the automotive industry has had since March, 1920.

Ford output was well over 70,000 and practically all other large producers turned out more motor vehicles than in any 30-day period in a year and a half.

This applies to all branches of the industry — passenger cars, trucks, tractors and parts. Passenger car output for the first quarter ran far ahead of the same period in 1921. The first quarter of 1920 was the largest the industry ever had. Truck production in the first three months of this year gained even more in comparison with the opening quarter of 1921.

Parts Sales Big

Sales of parts manufacturers in March were as large as in any month of 1921 and probably larger. The February total showed an increase of more than 100 per cent over the same month last year and was larger than in March of last year, which showed an increase of 93 per cent over February. A gain of only about 20 per cent for March of this year over the preceding month would put parts sales on a level with the banner month of last year. There is little doubt that an even larger increase will be shown.

Carload shipments of automobiles and trucks by all makers in March approximated 25,000. There have been only three months in the past 26 which have equalled this record. They were January 1920 with 25,057; February 1920 with 25,505 and March 1920 with 29,326. While the carload shipments in January and February 1920 were little larger than in March 1922, the number of driveaways was much larger. The comparison follows: March 1922, 15,800; January 1920, 29,283; February, 43,719; March, 57,273.

Carload shipments of automobiles and trucks in February numbered 19,600. The only months in a year and a half which have exceeded this figure were September, 1920, with

Business in Brief

NEW YORK, April 4.—Steel production continues to increase. Present rate of ingot production is somewhat above the levels of 1912 and 1913, the best pre-war years.

General freight tonnage carried by the railroads continues to increase, but the coal strike will bring about a sharp curtailment in the total tonnage carried. Car loadings for the week ending March 18 were 823,369, compared with 691,396 for the same week in 1921, and 855,060 for the corresponding week of 1920.

Railroads have released orders for 8,000 cars.

A return of 4½ per cent on the estimated valuation of Class 1 railroads is indicated by returns of 170 carriers for the month of February.

General indifference to the coal strike is still manifested in all industries.

Building operations, which already had approached record proportions, are increasing with the coming of spring.

Bank clearings for the week ending March 30 aggregated \$6,156,364,000, a loss of 9.6 per cent from the previous week, but a gain of 20.9 per cent over the same week last year.

Stocks are buoyant, bonds higher and money and exchange steady.

Marked improvement in the condition of the agricultural industry and a better outlook for business generally are indicated in April 1 reports received by the War Finance Corp. from all parts of the country. Live stock growers and farmers are much more confident.

Strong demand for cattle has developed. Sheep and lamb markets continue strong.

Meat stocks in cold storage are unusually small.

Cash wheat and corn markets continue strong.

Cotton market remains quiet with a slight drop in prices.

Wool and textile markets are quiet.

Unemployment is decreasing in the Middle West, and farmers are absorbing considerable surplus labor.

20,804; April, 1921, with 20,187; June, 1921, with 20,269; August, 1921, with 20,350, and September, 1921, with 20,150.

(Continued on page 789)

April Schedules Call for General Increase

**Detroit Hopes to Exceed March
Production Figures by
One-Third**

DETROIT, April 3 — Tentative April production schedules in Detroit motor vehicle factories call for a general increase over all recent months, and the March figures will be exceeded about one-third in practically every plant. The new Jewett and the new Columbia will be in quantity production for the first time.

One or two additional models in existing lines are scheduled to be brought out, Buick being ready to present a new sport phaeton accompanying its sport roadster first exhibited at the New York show and Liberty having a new roadster which will follow the lines of its new phaeton and which will sell at the same price.

Jewett will turn out about 1200 phaetons, which with 1800 Paiges scheduled will give that factory an April total of 3000. In March 250 Jewetts and 1750 Paiges were shipped. Columbia will build 500 of the new line in April and about 700 of the former models.

Ford will put over its first hundred thousand month of 1922 in April, the March total for all plants, domestic and foreign, running about 70,000. There is a pressing demand for inclosed cars, the Ford company declares, and orders on them are 30 days ahead of possible output.

Dodge Brothers will continue on a capacity basis of 550 cars daily and is also far behind on inclosed cars. To speed up production, the company is reported to have discouraged the sale of inclosed cars for the next two months to permit it to reach highest production on the open models.

Hudson-Essex, with a total production in March of about 5000, will increase this in April to a point that will give the company the largest April in its history.

Maxwell will build 250 cars daily in April, increasing from the approximate 200 daily schedule in March. Chalmers, in March has been speeded up to a point schedule materially higher for April than for recent months.

Studebaker will build 11,000 cars in April and has scheduled the balance of the summer on that basis. Production in the face of a price increase, reports a which gives the company 440 a day going into April.

(Continued on page 788)

All Recent Records Shattered

Factories in Flint Show Big Gain Made

Output for Months of First Quarter Leaps Far Above Last Year's

FLINT, MICH., April 4—Proof that the automobile industry is in a much healthier state than it was this time last year, and that its chances for improvement are good is evident from the statements of motor car company heads and the heads of allied plants.

"Our business for Feb., 1922, was 242 per cent greater than that of February last year," said H. H. Bassett, president and general manager of the Buick Motor Car Co. "March production was double that of last March, and there is every indication that our business will be better than the calendar year of 1921."

Chevrolet on Night Shift

Chevrolet Motor Car Co. has a schedule of close to 10,000 cars for April delivery, and last week started a night shift for the first time in several months. Nine hundred axles are now being turned out per day, and a production of 800 motors per day is the goal.

The Dort Motor Car Co. states that January showed an increase in production of 336 per cent as compared with Jan., 1921. February showed an increase of 150 per cent over January, and March made an equal gain over February.

Announcement has been made that the plant of the Flint Motor Axle Co. will soon be running on full time. The plant has been on a limited schedule for several months.

According to a statement made before a Chamber of Commerce group by John Edgerly, general manager, business for the Flint Varnish & Color Works, 95 per cent of whose output goes to motor car manufacturers, has improved 75 per cent.

Walter Heginbottom of the Marvel Carburetor Company reported good business conditions in the sales field for his company.

The Stewart Body Co. this week requested all of its mill employees to report for work.

Spark Plug Business Grows

Since January 1 the business of the A. C. Spark Plug Co., which before April 1 was known as the Champion Ignition Co., has steadily increased, according to B. de Guichard, assistant general manager. "This has been true both of shipments to jobbers and to manufacturers for original equipment," he said. "Business is more than double what it was this time last year."

Albert C. Champion is at present on a trip in Europe, and one of his duties is

Highway Legislation Now Before Congress Embodies Ideas of Automotive Industry

By Roy D. Chapin

President of the Hudson Motor Car Co. and Chairman of the Highways Committee of the National Automobile Chamber of Commerce

DETROIT, April 3.

PASSAGE by the United States Senate of a highways appropriation bill fixing allotments of \$50,000,000 for the fiscal year of 1923, \$65,000,000 for 1924 and \$75,000,000 for 1925, meets with the approval of the highway committee of the National Automobile Chamber of Commerce, and if accepted by the House will mark an important forward step in the development of a national system of highways.

It has been our earnest effort for several years to obtain the enactment of legislation which would guarantee to the States of the Union the continuance of Federal aid in the construction of highways over a period of years. In this present bill we have been successful.

To insure favorable action by Congress on the measure it devolves upon each and everyone in the industry to indicate his interest in the subject to his individual Congressional representative. Letters urging the early passage of the bill should go forward at once.

The steady growth of the highway system of the United States is a most important factor in the advance of the automobile industry. Federal participation in the highway plans and the assurance of it for future years is a vital force in stimulating the individual States to action.

to perfect the organization of the A. C. factory being started in Birmingham, England. It is probable that a branch factory will be started in Paris, France, in the near future.

Rolls-Royce Adds 200 Men to Machining Department

SPRINGFIELD, MASS., April 3—Rolls-Royce, Inc., is adding 200 men to its machining department this week. Increased production is also reported in bodies for the chassis. This expansion comes as the result of recent gains in sales and the improved prospects for spring and summer business.

Particularly worthy of note is the recent increase of business reported in the Chicago district, indicating that the North Central States are making a recovery from the agricultural depression that for months has retarded business.

Export Trade Picking Up, Wichita President Says

WICHITA FALLS, TEXAS, April 1.—Inquiries for trucks are greater than at any time since 1919 and export business is picking up, according to J. G. Culberson, president of the Wichita Truck Co. Culberson states that the plant is now turning out more than 60 trucks a month and that he expects soon to increase the output to the capacity of the plant, which is about 400 a month.

The company is doing business in half the States of the nation and is making shipments to several foreign countries.

Trucks Make Steady Strides to Recovery

Establish Gains Through Lighter Vehicles—Releases on Parts Increasing

DETROIT, March 29—The truck industry is making steady strides toward recovery and is coming back principally through the medium of the lighter vehicles. Every month this year has seen increased releases to the parts makers, March business doubling February, and April releases, already indicated, will double March.

Most of the releases are for parts for 1½-ton vehicles. There is considerable business in 2 to 3-ton sizes, but after three the business is light. For the present the heavy-duty truck has entirely given way before its lighter brethren.

Explanations for the buying of lighter trucks give it as an indication of a return of general business, but on a lighter basis than formerly and requiring more frequent deliveries of smaller shipments. It is also declared that many truck buyers, unable to finance the purchase of a heavy truck now, are using the lighter trucks temporarily.

All of the specialized unit truck builders are declared to be getting a volume of business, the amount depending largely upon their merchandising methods and the character of the clientele in which they specialize.

Nash Contract Has Price Cut Clause

Gives Dealers Six Months' Protection—Not to Be Rewritten Each Year

KENOSHA, WIS., April 3—A dealer contract which does not have to be rewritten each year, but holds good as long as the relationship between the factory and the dealer is mutually satisfactory and which gives dealers six months' protection on price reductions has been adopted by the Nash Motors Co.

Regarding the new contract, which is expected to be ready for distribution within a short time, Nash Motors to-day made the following statement:

The contract, once written, is continuous in the sense that it does not have to be rewritten each year, but holds good as long as the business relationship it cements is mutually satisfactory to the factory and the dealer.

The thought of the Nash Motors Co. behind this clause is that it wishes the Nash dealer to feel the permanency of his relationship with the factory and that he may retain this valuable franchise as long as he continues to give the Nash company satisfactory representation.

The second important feature of the new Nash contract is that the dealer is given protection on all current models of new Nash cars that he may have on hand and which may have been shipped him from the factory during a period of six months immediately prior to the announcement of any price reduction by the factory.

Saxon Leases Quarters in Ypsilanti Factory

DETROIT, April 3—The Saxon Motor Car Corp. has decided to remove its plant to Ypsilanti, where it has leased quarters in an automobile manufacturing factory already established. The company owns no real estate in Detroit and has rented the property it occupies here.

The Saxon company has requested its creditors to grant an extension of time on their claims. It believes that if this relief is granted, it will be able to extricate itself from its present difficulties. The plan proposed will not be put into operation unless 80 per cent of the creditors consent.

Protesting Methods Used, A. A. A. Secretary Resigns

WASHINGTON, April 1.—Resigning as secretary of the American Automobile Association and as editor of the "American Motorist," as a protest against the new methods of obtaining membership in the Washington district, the action of William Ullman has provoked widespread discussion in the automobile trade, especially among car dealers and owners.

Ullman has been prominently identified with organization work of A. A. A. for a number of years.

Simultaneously with his resignation

several prominent individuals connected with the local division of the A. A. A. likewise severed their connection.

According to the statement issued by Ullman, his resignation was due to the employment of professional membership promoters by the A. A. A., under a contract signed by George C. Diehl, national president. Ullman said that the management of the local district division was removed from control of the advisory board and placed in the hands of professional promoters and the annual dues increased from \$5 to \$10. He claimed that hundreds of protests were received as to the methods used by the promoters against the increase of membership dues.

Denial that the organization was being commercialized has been made in a formal statement by Diehl. He contends that the increase in dues which Ullman protested was made to put the District of Columbia on an equality with other clubs which pay the \$10 rate. Diehl insisted that it was a legitimate campaign which had been authorized.

A. E. A. Committee Works Toward Uniform Practice

CHICAGO, April 1.—The Standardization Committee of the Automotive Equipment Association met last week at Cleveland and adopted recommendations concerning 109 items of automotive equipment. The recommendations have to do with packing, marking and the elimination of sizes and types. The purpose of the committee is to endeavor to establish uniform practices among manufacturers as to sizes and types and methods of packing and marking. The elimination of unnecessary sizes and types is expected to result in considerable saving to makers and dealers.

The committee is now at work on the preparation of a handbook in which the recommendations it has adopted will be listed. The book also will contain extracts from the recommendations of the Society of Automotive Engineers. It will be a loose leaf book and additional sheets will be published as new recommendations are made.

KERN TO MAKE STATEMENT

WASHINGTON, April 3—The Alien Property Custodian announces that investigation of the sale of the Bosch-Magneto Co. to Martin E. Kern of Allentown, Pa., is still far from complete. Upon his return from Europe, Kern came immediately to Washington for a conference with officials of the department. He has stated that he soon will issue a statement of his case.

RECEIVER FOR LEASE MOTORS

NEW YORK, April 3—A petition in bankruptcy has been filed against the Lease Motors Co., Inc., manufacturers of motor trucks at Long Island City. The liabilities are said to exceed \$75,000 and the assets, \$50,000. The petitioning creditors have claims aggregating \$1,600. Judge Knox has named Ely Newmann receiver.

Holders of Chalmers Notes Form Committee

Company Defaults in Payment of Interest—No Bearing on Maxwell Finances

NEW YORK, April 3—A committee to protect the interests of note holders of the Chalmers Motor Corp. has been formed here as the result of the default by the company in the payment of \$94,000 interest due April 1 on \$3,150,000 first mortgage, 6 per cent gold notes. The committee is headed by M. N. Buckner, chairman of the board of the New York Trust Co., with Alfred A. Cook as counsel. The other members are Philemon Dickinson of C. D. Barney & Co. and Martin F. Stern of J. S. Bache & Co.

It is stated by the committee that in its judgment "it is imperative that prompt and concerted action be taken by the note holders for their protection and that the notes should be deposited immediately." In order to participate in the benefits of the protective agreement, holders of notes must deposit them on or before April 20 with the New York Trust Co.

Maxwell Merely Stockholder

Walter P. Chrysler, chairman of the board of the Maxwell Motor Corp., stated to-day that he had no statement to make at this time in reference to the default on the Chalmers notes. It is asserted, however, that it has no direct bearing on the Maxwell finances, as the latter company simply occupies the position of stockholder and creditor toward the Chalmers company, having no liability for Chalmers notes or accounts.

When the reorganization plan to effect a merger of the Maxwell Motor Co., Inc., and the Chalmers Motor Corp. was declared effective, the first mortgage Chalmers notes were left undisturbed by the plan. The Maxwell Motor Corp., which was incorporated in West Virginia a year ago, owns more than 95 per cent of the capital stock of the Chalmers corporation. The Chalmers first mortgage notes, which are dated Sept. 1, 1917, were issued to provide \$3,000,000 in cash to be used by the Maxwell Motor Co., Inc., under the terms of its lease of the Chalmers plant. They constituted a first lien on the real estate, buildings, plants and other assets formerly leased by the Maxwell Motor Co., Inc., and now a part of the property of the Maxwell Motor Corp.

Officers of the Maxwell corporation assert that its financial position is extremely strong. This is reflected in its ratio of quick assets to demand liabilities which are between six and seven to one. It is expected that capacity production will be approached in the next few months.

Aim Is Constructive Action

DETROIT, April 5—B. E. Hutchinson, vice-president and treasurer of both the Maxwell and Chalmers corporations, said

(Continued on page 791)

Stewart-Warner Wins Another Patent Suit

Decree Concerning Vacuum Feed Tanks Issued Against Ireland & Matthews

DETROIT, April 3—The application of the Stewart-Warner Speedometer Corp. for an injunction to prohibit the manufacture and distribution of vacuum gasoline feed tanks by Ireland & Matthews Manufacturing Co. of this city has been granted by Judge Tuttle in Federal Court here. The decree also ordered the Ireland & Matthews company to render an accounting to the Stewart-Warner company on account of infringement of the latter's patents.

It was held by the court that the Webb Jay patents covering the vacuum gasoline feed system, owned by the Stewart-Warner company, were infringed by the Weinberg tank, which was the type manufactured by Ireland & Matthews. Stewart-Warner has won a number of other similar suits against other manufacturers.

Opinion of Court

The interlocutory decree entered by Judge Tuttle is as follows:

1. That United States letters patent No. 1,132,273, granted to Webb Jay, dated March 16, 1915, for improvement in fuel feeding devices for internal combustion engines are good and valid letters patent as to claims nine and fourteen thereof.

2. That the complainant, Stewart-Warner Speedometer Corp., possesses the full right to said invention as covered by said patent No. 1,132,273, by virtue of an exclusive license thereunder from the complainant, Webb Jay, that the complainant Webb Jay is the owner, subject to said exclusive license, of the whole right, title and interest in and to said patent 1,132,273.

3. That the defendant, Ireland & Matthews Mfg. Co., has, by making, selling and using devices substantially such as shown in said United States patent 1,132,273, infringed claims 9 and 14 of said patent and has violated the exclusive rights of the complainant thereunder.

4. That the complainant recover of the said defendant all the gains and profits made by it and all the damage sustained by said complainant by reason of said infringement by said defendant of said claims 9 and 14 of said patent 1,132,273; that said cost be referred to William S. Sayres, Jr., having experience and special fitness in matters of accounting, residing in Detroit, Mich., as master pro hoc vice to ascertain and report to the court the number of said infringing devices made, used or sold by said defendant since said March 16, 1915, from infringing the said exclusive rights of said complainant by the manufacture, use or sale of devices infringing said claims 9 and 14 of said United States patent 1,132,273 and also the damages which the complainants have suffered by reason of said infringement.

5. It is further adjudged, ordered and decreed that a writ of injunction in accordance with the prayer of the bill of complaint herein be issued by, from and under the seal of this court perpetually restraining and enjoining the defendant, its agents, employees, servants, workmen and all others acting under or by its authority, from any further acts infring-

GOVERNMENT TO FILM STORY OF PRODUCTION

WASHINGTON, April 6—Plans have been completed for the production of a motion picture film to be called "The Story of an Automobile," produced under the direction of the Automotive Division, Department of Commerce. It is part of their plan to interest the public in production methods. It has been announced that the work of filming the various processes will be started April 18.

Arrangements have been made with Dodge Brothers to show the complete methods of manufacture of an automobile from the new material to the finished product, and will bring out in a clear way the efficient methods used in this connection, as well as present in a graphic way the welfare work being carried on in the industry. No pictures will be released without complete approval of Government officials, and every effort will be made to give wide circulation to the films.

This line of endeavor on the part of the Automotive Division is in keeping with the policy of Secretary Herbert Hoover of placing every resource of the Government at the command of the automotive industry to promote the export trade and maintain the supremacy of American automotive products in the markets of the world.

ing the said claims 9 and 14 on said patent 1,132,273.

6. That the complainant upon said accounting aforesaid have the right to cause an examination of the said defendant or its employees or any of them and also to examine the account books, vouchers and documents of the defendant for the purpose of ascertaining the character and amount of such infringement and that the defendant and its employees and all other persons having custody of such account books, vouchers and documents of the defendant attend for this purpose before the said Master in Chancery at such time as said Master in Chancery shall direct.

7. That said complainants recover of the defendant their costs, charges and disbursements in this suit to be taxed.

Bassick Company Moves to New Chicago Plant

CHICAGO, April 3. — The Bassick Manufacturing Co., manufacturer of the Alemite lubricant system for automobiles, has moved to its new plant at 2630 North Crawford Avenue. The new plant has 70,000 square feet of floor space. It is one story high and of sawtooth construction, and so designed that artificial light will rarely be necessary. The ground area covers about 160,000 square feet, which allows for expansion.

The officials of the company state that there is an increased demand for their product and that 300 automobile dealers are using their equipment.

Reynolds Spring Co. Enters Radio Field

Accepts \$5,000,000 Contract to Make Apparatus for New York Concern

DETROIT, March 31—Reynolds Spring Co., one of the largest manufacturers of automobile cushion springs in the industry, has accepted a contract from the DeForest Radio Telephone & Telegraph Co., New York, for the manufacture of its radio apparatus and parts over a period of ten years. An initial order approximating \$5,000,000 will be shipped between April 1 and Dec. 31, 1922.

To manufacture the radio apparatus the company will employ its former plant in East Avenue, Jackson. Manufacture of its automobile springs was transferred recently to a new plant in Water Street, that city. The manufacture of the two differing lines will thus be kept entirely separate.

Announcement of the company's new activity was contained in a letter sent by President Wiley R. Reynolds to stockholders, in which he expressed the belief that the radio business will make rapid strides. No new financing will be necessary to enable the company to proceed with its radio business.

A license for the manufacture of bakelite has been obtained from the General Bakelite Co., New York, under which the company will begin the manufacture of new parts for the automobile industry as well as for radiophone purposes. The bakelite products will be marketed through a separate selling organization. From 300 to 500 employees will be added.

Trade Bodies to Discuss Exports with Gordon Lee

NEW YORK, April 3—A meeting of the export committees of all the automotive trade associations has been called for April 13 at Washington by Gordon Lee, chief of the automotive division of the Bureau of Foreign and Domestic Commerce. The purpose of the conference will be to exchange ideas on how best to promote sales abroad of American-made automotive products. The advisability of holding periodical meetings of export managers at Washington also will be considered.

The organizations which have been invited to send representatives to the meeting include the National Automobile Chamber of Commerce, The Motor and Accessory Manufacturers Association, the Society of Automotive Engineers, the Motorcycle and Allied Trades Association, the Aeronautical Chamber of Commerce, the National Association of Motor and Engine Manufacturers, the National Association of Motor Truck Industries, the Association of Automotive Equipment Manufacturers and the Class Journal Co.

International 1921 Profit, \$4,149,000

Was Derived Entirely from Foreign Trade—Gross Sales Declined

CHICAGO, April 3.—The International Harvester Co. for 1921 reports gross sales of \$121,215,000, a reduction of 46 per cent from the total for 1920. The net profit for the year was \$4,149,000, compared with \$16,655,300 the year before. The business done in this country produced no profit, says the report, the profit shown having been derived entirely from the company's foreign trade.

The net profits for the year fell far short of dividend requirements, which called for cash payments of \$4,215,673 on the preferred stock, \$5,112,786 on the common stock, and \$3,645,414 for stock dividends. These amounts, less the profits reported, were charged to the profit and loss surplus, which reduced the account to \$59,526,787 at the close of 1921, compared with \$68,350,741 at the end of 1920.

Current assets were listed in the balance sheet at \$179,554,282 and current liabilities at \$27,507,540, leaving net working capital of \$152,046,742. The assets included: Inventories, \$114,085,765; accounts receivable, \$56,283,380; investments, \$823,484, and cash, \$8,361,651.

Harold F. McCormick, president of the company, in his remarks to stockholders, said that the year 1921 was the "worst in the history of the agricultural implement business." Continuing, he stated:

Shipments to Russia

Notwithstanding the conditions adverse to foreign trade, the volume of the company's business abroad in 1921 compared much more favorably with 1920 than did the business in the United States. During the year the company sent machines to Russia, receiving the entire purchase price of approximately \$1,600,000 in United States money. This is the first transaction of this kind in some years. Substantial shipments were made to Poland, credit being granted for part of the purchase price under guaranty of the Polish Government.

Representatives of the company visited the works at Lubertzy, near Moscow, Russia, during the fall of 1921. The Russian works have not been nationalized and have been continuously under the management of the company's employees. The property is reported to be in excellent condition. Agricultural machinery is being manufactured there and distributed to the Russian trade.

McCormick in his remarks in general said that the "rapid and severe decline during that period in the price of practically all farm products greatly diminished the purchasing power of the farmer and had a depressing effect upon the implement business, which is dependent for its success upon the prosperity of its ultimate customer—the farmer."

Company Returns to Kentucky

LOUISVILLE, March 30.—The return of the International Harvester Co. to Kentucky will be marked by the opening of bids on the new office and warehouse building, to be erected here. The company moved its Louisville plant to New Albany about eleven years ago, following the enactment by the Kentucky Legislature of several anti-trust laws. Since

then, however, the laws have been modified or repealed, and the officials of the company were induced to bring the plant back to Louisville.

J. L. Gardner, general manager of the New Albany factory, states that the cost of the building is uncertain. It will have a frontage of 174 ft. and will be four stories high. The floor space will amount to 70,000 sq. ft.

\$250,000 Back Royalties Awarded to Inventor

MINNEAPOLIS, April 3.—R. B. Hartsough of Minneapolis has been awarded more than \$250,000 in back royalties and interest on the "Happy Farmer" tractor, in a suit begun in 1919 in the Federal court for western Wisconsin and carried through to the Circuit Court of Appeals for the Seventh District, sitting in Chicago. The suit was brought against Albert Hirschheimer, of La Crosse, and others.

He claimed to have designed the tractor and to have built it in small quantities prior to 1915, when he entered into agreement with the defendant whereby the latter received the manufacturing privilege and was to pay Hartsough on the basis of 3 per cent on the retail selling price of each machine. It was alleged that Hartsough was induced in 1916 to cancel his contract, following which Hirschheimer reorganized the company and resumed manufacture as the La Crosse Tractor Co. The contract is restored and the cancellation set aside by the court action.

Charge of Auto Stores' Head Not Sustained

PHILADELPHIA, April 3.—Albert E. Williamson, Boston, and Adolph Maymayer, Brooklyn, whom Edward B. P. Carrier, president of the bankrupt United Auto Stores, Inc., had arrested for alleged conspiracy to wreck the concern, have been discharged by a magistrate.

The former head of the Auto Stores charged that Williamson, whom he had brought in to reorganize the United Guaranty Corp., the stock-selling agency for the Auto Stores, and Maymayer, who had been head of the sales force, had thrown the business into a receivership for their own gain. After reviewing the testimony, the magistrate asserted that he found no grounds for holding Williamson and Maymayer.

SANCTIONS AUSTIN PLAN

LONDON, March 17 (By Mail).—The High Court has formally sanctioned the plan of the creditors of the Austin Co. for the continuance of the business on approved terms. The effect of this decision is to close the protracted litigation affecting the company, to affirm that, in the court's opinion, the company can carry on its business at a profit and to leave it free to do so. The company is reported to be making a fair net profit, the new "Twelve" model having proved a great success.

Translates Balance Sheet for Dealers

Hart-Parr Co. Sets Out Facts So They Can Be Understood Readily

CHARLES CITY, IOWA, March 31.—The Hart-Parr Co. has made a departure from the usual method of handling annual financial statements and has translated it into the simplest terms, so that it can be understood readily by distributors and dealers to whom it has been sent.

The balance sheet, as it has been prepared by the Hart-Parr Co., follows:

We have cash in bank	\$190,232.23
Certificates of deposit and miscellaneous notes and accounts (less allowances)....	225,516.74
Merchandise Inventories	515,057.19
The above total represents our current assets as separated from fixed assets, buildings, etc.....	930,806.16
This gives us total net quick assets of..	\$769,970.18
In addition to the quick assets we have a total investment, (less depreciation) in buildings, equipment and miscellaneous property which we term as fixed assets of	1,326,860.63
Against these fixed assets we have liabilities of	524,597.09
These liabilities include reserves set up not paid, money owing on buildings, which is being paid off yearly, none of which is past due, and equipment. The net credit balance on fixed assets is.....	802,262.54
This makes a total of net assets of.....	1,572,232.73

This amount of money is the value of the stockholders' investment in the company after paying all obligations. In our assets there is no item of good will, patents or anything else but that is a tangible asset.

Sterling Knight Buys Accurate Machine Plant

CLEVELAND, April 3.—The Sterling Knight Motor Car Co. has purchased the \$1,000,000 plant of the Accurate Machine Co. here. Engineering and mechanical experiments have been carried on for more than two years by James G. Sterling, vice-president and treasurer of the company, assisted by a number of men who have been with him in other ventures.

The Knight engine has been changed in some respects and the idea of the company will be to build distinctive custom chassis, using this type engine. No price has been set, as the early production will be priced to the particular job.

Washington Active on Trade Body Work

Congressional Committee May Aid in Defining Rights of Associations

WASHINGTON, April 5—A resolution providing for the creation of a committee to investigate existing conditions of industry and commerce in the United States for the purpose of recommending to Congress legislation defining the rights and limitations of cooperating organizations as distinguished from illicit combinations in restraint of trade, has been introduced by Senator Edge of New Jersey.

A similar resolution has been introduced in the House by Representative McArthur of Oregon.

Outgrowth of Court Decision

This action is the direct outgrowth of the Supreme Court decision in the hardwood lumber case, which left in an exceedingly nebulous state the question of what activities are permissible for trade organizations.

A committee appointed by the Chamber of Commerce of the United States, of which Alfred Reeves, general manager of the National Automobile Chamber of Commerce, is a member, is holding a meeting here today to discuss what can be done to determine definitely the activities in which trade associations may engage.

Secretary of Commerce Hoover has called a conference here for April 12 of representatives of trade associations to consider the compilation and dissemination of statistical information concerning various industries.

McArthur's Resolution

The resolution introduced by Representative McArthur follows:

Whereas the revival of the industrial activities of the United States is essential to the welfare of the individual as well as the nation, and whereas business has been suffering severe depression from which its reconstruction should be stimulated by every legitimate means, and whereas business procedure that will without protecting monopolies, eliminate waste in production or distribution, lower costs, simplify and standardize methods, increase efficiency and the morale of business, is a beneficial factor in economic progress, and

Whereas, Congressional action has already been taken to assist in agricultural co-operative marketing and distribution; and

Whereas, The industrial tendency is toward the substitution of research and scientific business methods and previous uncertainty and ignorance; and

Whereas, business is hesitating because unable to secure guidance, legal or governmental, which will clearly indicate the proper lines of conduct in business association; and

Whereas, business is entitled to know in definite terms what it legally can and cannot do;

A joint committee of Congress be created, to be composed of six members from each branch, whose duty it shall be to investigate existing conditions of industry and commerce

in the United States and the markets of foreign countries, insofar as the same directly affect industry and commerce of the United States, including questions as to production, distribution, labor and business methods, and to report to Congress and to suggest such legislation, if any, as it may deem best upon these subjects with special reference to the most effective ways and means to revive industry and to stimulate foreign and domestic trade, to stabilize business conditions as to the future, to minimize the danger and distress of recurring periods of business depression with their resultant cycles of general unemployment, and to define the rights and limitations of co-operative organizations as distinguished from illicit combinations in restraint of trade.

Lincoln-Ford Company Formed for \$15,000,000

DETROIT, April 4—The Lincoln-Ford Motor Car Co. has been incorporated in Michigan as a successor to the Lincoln Motor Co. It is capitalized at \$15,000,000, all in common stock, of which \$250,000 has been subscribed and paid for in cash.

All but three of the 2500 shares of stock already issued are held by Edsel B. Ford. The other stockholders are Henry Ford, Henry M. Leland and Wilfred C. Leland, each of whom holds one share.

Officers of the new company are: President, Henry M. Leland; vice-president and general manager, W. C. Leland; second vice-president, Edsel Ford; secretary and treasurer, W. T. Nash; assistant secretary and treasurer, B. J. Craig. The directors are the Lelands and the Fords. The Lelands continue in the positions they held in the original Lincoln company as does Nash. Craig is secretary of the Ford Motor Co.

It is understood that it has not been determined how the stock of the new company finally will be distributed between the Ford and Leland families.

Ohio Halts Stock Sale by Seven Rubber Firms

AKRON, April 3—Further stock sales by seven Ohio rubber companies with an aggregate capital stock of \$12,979,925, have been ordered stopped at once by Arthur L. Stewart, Ohio state securities commissioner. Stewart's action in withdrawing permission for further stock sales, in addition to these rubber companies, affects 23 miscellaneous companies with a total par value for the 30 companies' stock of \$17,917,555.

The seven rubber companies whose sale of stock has been stopped by Commissioner Stewart's orders are:

D. & M. Cord Tire Co., Cleveland; Phoenix Rubber Co. of Akron; Glamorgan Tire & Rubber Co. of Orville; Avalon Rubber Manufacturing Co. of Akron; Andes Tire & Rubber Co. Cleveland; Nu-Air Tire & Rubber Co. of Cleveland; Maguire Tire & Rubber Co., Cleveland and Tuscara Rubber Co. of Denver.

Among the miscellaneous companies whose stock sales have been halted are:

Halladay Motors Corp. of Newark; Tuscara Rim & Machine Co. of New Philadelphia; Twin Dry Cell Battery Co. of Cleveland.

Timken Prepares Way for Profitable Year

Readjustment Indicated in Balance Sheet—Inventories and Accounts Payable Cut

DETROIT, March 29—The balance sheet of Timken-Detroit Axle Co. as of Dec. 31 last shows total assets of \$19,105,138 as compared with assets of \$21,494,864 at the end of 1920. Current assets were \$8,350,104 and current liabilities \$2,427,301. Net working capital of \$5,922,803 compares with \$8,762,148 a year ago.

Inventories carried at \$10,932,521 have been reduced to \$7,258,281. Accounts payable of \$3,458,647 a year ago have been decreased to \$438,824, a large part of this, \$1,950,000, by substituting bank loans for the accounts.

Cash position is \$502,986 as compared with \$671,151 in 1920. Customers' notes and accounts receivable total \$503,064 against \$733,278. Marketable securities of \$85,772 were added to the assets. Accrued expenses and dividends increased from \$36,573 to \$38,477. Other assets were \$480,276 as against \$601,910.

Accumulated surplus was \$8,736,737 as against \$9,866,662, the difference being accounted for by writing down inventories to market values, payment of dividends at 7 per cent on preferred stock and 2 per cent on common, and the taking of a moderate operating loss on the year.

Outstanding preferred stock was reduced from \$4,975,000 to \$4,962,700. Outstanding common stock is \$2,978,400.

President A. R. Demory says:

We feel we have readjusted ourselves to a position where this year should show a profit. Specifications for immediate delivery of axles have increased very materially. We have acquired some new customers, retained all our old ones, and feel confident that we are in shape to work out this very trying problem and maintain the very strong standing we have always enjoyed. We should end the year 1922 with a very satisfactory showing.

Spicer Reports Profit

NEW YORK, April 3—Spicer Manufacturing Co. for the year ended Dec. 31, 1921, reports an operating profit of \$12,674 after administrative and selling expenses and plant depreciation. The net loss, after interest charge deductions, was \$435,257, the first to be reported since the formation of the company.

The general balance sheet shows current assets of \$5,589,824 and net current liabilities of \$1,881,368. The former consists of \$4,067,128 inventories; \$1,136,842, accounts payable; \$80,936, investments, and \$304,918 cash. Among the current liabilities are notes payable amounting to \$1,321,000.

C. A. Dana, president, states that sales for the first three months of 1922 were approximately double those of the same period last year. Orders are coming in at such a rate at the present time that the company has put on a night shift at its Plainfield, N. J., plant.

April Schedules Call for General Increases

Detroit Plants Will Exceed March Production Figures by One-Third

(Continued from page 782)

Hupp Motor Car Corp., with a production in March of slightly over 3000, has scheduled 4000 for April. The March total ran considerably higher than scheduled, and April is also expected to run higher.

Liberty will build about 600 cars in April. March figures after a late start ran higher than 350.

Cadillac, at capacity since the early part of the year, will continue its schedule of about 100 cars daily.

Lincoln has scheduled 750 cars for April, all that the factory in its present state of reorganization can build. Orders already covering production to July 1 are on the books at the factory.

Rickenbacker, with an output of over 300 cars in March, has scheduled between 500 and 600 for April. The factory is now fully equipped to meet production requirements.

Steady Flow of New Business

There is a firm feeling among the sales executives at the factories that steady business in automobiles is assured for at least the summer period. Though the bulk of the demand is from present owners, there is a steady flow of new business from persons without cars to exchange.

Most of the new business is in the big industrial centers, officials declare, with a good demand, however, from the smaller cities and considerable buying in the rural districts. Cities in the Middle West, which were thought to have reached a point where replacement business was for the most part the only business to be expected, are reported showing a surprising volume of first sales.

Toledo Plants Active

TOLEDO, April 3—The Willys-Overland Co. has led all Toledo automotive plants in getting back into large scale production during March. The plant took on 1200 employees during the month and now has a total of 7525 at work.

Milburn and Chevrolet held their own, while many of the accessory plants took on more employees and boosted output.

The Electric Auto-Lite division of the Willys Corp. increased its employees by 300 last week and has about 2000 at work now.

In a recent survey of 130 Toledo plants it was found that 30 were at 100 per cent production, 69 were operating at 75 per cent or better. Many of these were in the automotive group. Malleable iron foundries have shown a big pick-up in production.

The Bock Bearing Co., Doehler Die Casting Co., Bunting Brass & Bronze Co., and many others are among these operating with two or three months

Trend is Upward

BRISTOL, CONN., April 3—The New Departure Manufacturing Co. is steadily increasing its output and there now are 2300 men on the payroll, an increase for the first three months of this year equal to the increase in the entire previous year. The number now is nearly twice as large as in any pre-war month.

MARYSVILLE, MICH., April 3—C. H. Wills & Co., manufacturers of the Wills Sainte Claire car, announce that February business was 50 per cent over January; the first twenty days of March showed an increase of 60 per cent over February, and April orders already booked give a definite increase in business of 100 per cent over March.

MOLINE, ILL., April 3—The Deere Co., producing tractors and farm implements, has greatly increased its forces and is operating on a basis of five and one-half days a week. Orders on hand will enable the company to maintain the present force and time schedule for several months.

SALEM, OHIO, April 4—Mullins Body Corp. reports that it has received sufficient new orders for its product to increase production to 70 per cent of its plant capacity.

DETROIT, April 4—Kelsey Wheel Co. has contracted with the Ford Motor Co. to supply 360,000 sets of wheels during the current year.

orders ahead and with increasing working forces.

The outlook for spring manufacturing is very good.

Budd Will Be at Full Capacity for 10 Months

PHILADELPHIA, April 3—The Edward G. Budd Manufacturing Co., maker of all-steel bodies, has enough unfilled orders to keep its plant operating approximately at capacity for the next ten months. Business has been increasing to such an extent that some of the working force is employed at night.

The ratio of high, medium and low-priced bodies being sold is normal. Prices have been reduced about 40 per cent on the average, which has contributed to cuts in the prices of completed motor cars. The majority of medium and high-priced models, according to the company, reaches ultimate consumers in Eastern and Middle Western Cities. Most of the low-priced models are distributed eventually west of the Mississippi. The Budd company is doing no foreign business.

Canadian Shipments 1,442 in January

With Those from United States Total Exports Aggregated 2,871 Vehicles

OTTAWA, ONT., April 3—Export shipment was made during the month of January of 1442 passenger cars and motor trucks from Canadian factories. The details of these shipments have just been issued by the Department of Trade and Commerce and show that the United Kingdom, Australia, Argentina, India, British South Africa and New Zealand were the principal buyers. The figures follow:

MOTOR TRUCKS		
To	No.	Value
United Kingdom.....	32	\$13,792
Australia	15	6,856
India	26	11,885
Ceylon	6	2,745
Straits Settlements.....	12	5,486
Dutch East Indies.....	3	1,370
Other Countries.....	4	1,228

PASSENGER CARS		
To	No.	Value
United Kingdom.....	564	\$358,599
United States.....	5	7,240
Argentine Republic.....	102	62,968
Australia	367	248,156
Brazil	6	2,662
India	115	76,388
British East Africa.....	8	2,766
British South Africa.....	45	35,741
China	10	8,642
Dutch East Indies.....	15	7,723
Japan	10	8,839
Netherlands	4	2,879
New Zealand	36	32,049
Norway	4	3,698
Siam	2	1,850
Spain	5	5,120
Sweden	12	5,490
Other Countries.....	34	33,858

AUTOMOBILE PARTS	
To	Value
United Kingdom.....	\$131,133
United States.....	2,907
Argentine Republic.....	473
Australia	4,992
India	29,470
Straits Settlement	936
British East Africa.....	4,750
British South Africa.....	2,118
British West Africa.....	182
Dutch East Indies.....	9 621
New Zealand.....	154
Other Countries.....	2,187

Automotive exports from the United States during January were 2407 cars and 464 trucks, a total of 2871 vehicles. Thus, combining the United States and Canadian shipments, the overseas trade in January was 4313 automotive vehicles.

"GOVERNOR" BILL KILLED

NEW YORK, April 3—The Board of Aldermen have killed the proposed ordinance to have motor vehicles equipped with a governor to regulate their speed through the city streets. A special traffic committee is framing in its place an anti-speed ordinance.

Equipment Trade Runs Ahead of 1921

**Increase of 20 to 40 Per Cent
Along Atlantic Seaboard
Is Reported**

NEW YORK, April 5—Wholesale business in automotive equipment for the past three months of the year has been running 20 to 40 per cent ahead of last year in volume in different sections along the Atlantic seaboard. Jobbers from Maine to the District of Columbia, who attended the meeting of the Eastern Automotive Equipment Association, unanimously reported steadily improving conditions.

Owing to lower prices money volume so far has not been much greater, and in some districts not as great as last year, but it is increasing every day and indications are that April and May will be far better months from a revenue standpoint than the same period a year ago.

The jobbers reported that more than half the territory, at least, was being covered with meetings in the sales promotion campaign, with frequent showings of the "Ask 'em to Buy" film.

A resolution was forwarded to the Automotive Equipment Association in Chicago, suggesting that in future the manufacturing division of the organization should finance the general administration of the sales promotion campaign, inasmuch as the members of the jobbers' division are supporting the local and sectional meetings.

Hudson and Cadillac Export Business Gains

DETROIT, March 30—Hudson export business is showing very satisfactory activity, President Roy D. Chapin said this week. Every foreign agency of the company is reporting renewed interest in automobiles, and shipments are already going forward in a gratifying volume.

The company has increased to some extent its representation in foreign fields and retained all its force through the period of depression. By keeping closely in touch with conditions at all times, Chapin said, Hudson-Essex has been able to reap the early benefits of the return of trade.

Cadillac Motor Car Co. reports a large increase in shipments of parts to foreign territory over last year. In Buenos Aires the increase was 213 per cent; Christiania, Norway, 37 per cent; Geneva, Switzerland, 135 per cent; Havana, 315 per cent; London, 138 per cent; Sydney, 420 per cent, and Utrecht, Holland, 651 per cent.

FORD TO RESUME AT ATLANTA

ATLANTA, GA., April 5—Preparations are being made to resume operations at the Ford assembly plant in this city, in which no cars have been put to-

TOTAL CARS AND TRUCKS PRODUCED IN MARCH WERE 190 PER CENT OF SAME MONTH, 1921

NEW YORK, April 5—Carload shipments of automobiles and trucks by all makers in March are estimated at 25,000. Production for the month by members of the National Automobile Chamber of Commerce were 135 per cent of February and 190 per cent of March 1921. The factory shipment figures for the first three months of 1920, 1921 and 1922 follow:

	Carloads			Driveaways			Boat		
	1920	1921	1922	1920	1921	1922	1920	1921	1922
January	20,067	6,485	15,241	29,283	3,185	7,397	....	93	154
February	25,505	9,986	19,600	43,719	7,507	9,950	....	99	169
March	29,236	16,287	25,000	57,273	9,939	15,800	....	75	264

Factory shipments for the other months of 1920 and 1921 follow:

	Carloads		Driveaways		Boat	
	1920	1921	1920	1921	1920	1921
April	17,147	20,187	64,634	14,197	....	1,619
May	21,977	18,608	74,286	15,193	....	2,381
June	22,516	20,269	60,746	18,834	8,350	3,947
July	23,082	19,470	52,342	15,320	8,702	3,725
August	23,386	20,350	34,060	14,290	7,095	3,565
September	20,804	20,150	24,431	13,550	5,469	3,580
October	17,209	17,323	14,127	11,257	2,519	2,300
November	13,253	14,061	9,497	10,509	659	1,386
December	11,802	12,100	6,469	7,500	89	134

gether in more than a year. Between 300 and 350 men will be given employment. Ford business in the southern states has increased more than 100 per cent in the past 30 days, it is stated. This indicates decided improvement in general business and financial conditions.

Carload Shipments Approximate 25,000

(Continued from page 782)

While it is not to be expected that the sale of motor vehicles will continue to show such astonishing gains for the rest of the year as compared with 1921, it now can be stated definitely that the volume of business will be larger than last year. Unless some entirely unforeseen obstacles arise to retard the general recovery of the country from industrial depression, truck manufacturers and parts makers are certain to have a materially larger volume of business than they did in 1921.

The only element of doubt is in the passenger car field, and it now appears highly probable that earlier predictions that the volume of sales would not exceed those of 1921, when they approximated 1,500,000, were too conservative.

Within the past few weeks strong impetus has been given to the sale of small and medium sized tractors. This reflects improved conditions in the agricultural sections of the country. The same improved tone has been apparent in the truck market in these districts, and farmers are even showing renewed interest in inexpensive passenger cars.

Dealers in all sections of the country report better business.

High Level Is Reached In Studebaker Sales

**13,000 Cars Sold in March —
Quarter 100 Per Cent
Better Than 1921**

NEW YORK, April 3—Sales by the Studebaker Corp. of approximately 22,000 cars for the first quarter of 1922 exceeded sales for the same period of last year by approximately 100 per cent. March sales of 13,000 cars established a new record. The figures were disclosed by President A. R. Erskine upon his arrival here to attend the annual meeting of the corporation.

Improvement General

"New sales records were established in practically every city in the country," he said, "while business from rural sections and export markets showed very much strength and improvement. Production in March was 10,433 cars, a new record, and for the quarter, 26,675 cars, compared with 10,973 last year, an increase of 143 per cent. Stocks accumulated during the winter for the spring trade rapidly diminished in March and will be fully absorbed in the second quarter."

Retail sales figures for March in the following cities were given out by Erskine: New York, 1282; Newark and vicinity, 678; Chicago, 538; Detroit, 306; Los Angeles, 261; Cleveland, 184; Milwaukee, 145, and South Bend, 106.

New Director Chosen

C. L. Bockus was elected a director to succeed the late A. Barton Heyburn.

Erskine stated that the possibility of the payment of a stock dividend on Studebaker common stock has not been discussed by the directors. The dividend meeting is scheduled for April 29.

Men of the Industry and What They Are Doing

Henderson Leaves Martin-Parry

R. P. Henderson, since 1916 associated with the Martin-Parry Corp., has resigned as vice-president of that corporation and has moved from Indianapolis to Detroit. Two years after his association began, the success of the body builders attracted the attention of eastern capitalists to the importance of commercial bodies as offering an independent and profitable line of production, and as a result the Parry plant at Indianapolis and the Martin plant at York were taken over and operated under the name of Martin-Parry Corp. with Henderson as vice-president in charge of sales. Before taking up his work with the corporation, he was connected with the Cole Motor Car Co., of which he was a director. In 1913, following the successful coast to coast highway tour staged by the Indiana Automobile Manufacturers Association, Henderson was elected to the presidency of that organization.

Hannum and Nephler on Tour

George H. Hannum, president and general manager, and C. J. Nephler, general sales manager, of the Oakland Motor Car Co., have left for a three weeks' tour of the Pacific Coast, visiting the principal Oakland dealers and distributors and Oakland branches. In the course of the trip they will visit their recently created branch at San Francisco, which was changed from a distributorship.

Vail Reconsiders Resignation

At the request of the Waltham Watch Co., E. L. Vail has reconsidered his resignation at head of its automotive equipment division and has signed a contract covering a period of years as manager of the division. He will have immediate supervision over sales and service in that department. Vail practically created and developed the business of the company on Waltham automobile clocks and, later, introduced the Waltham speedometer. Retaining Vail's services is indicative of the company's plans to strengthen further and build up its automobile clock and speedometer business.

Jacobson Forms Rico Ignition

Edward B. Jacobson has severed his connection with the J. & B. Manufacturing Co., Pittsfield, Mass., and has organized the Rico Ignition Co., that city, to handle a full line of ignition specialties. Jacobson's entrance in the industry dates back twenty-seven years, when he began in the ignition business in Boston. Seven years later he moved to Pittsfield and continued to figure prominently in the trade of the country. He was instrumental in starting the Pittsfield Spark Coil Co. as well as the J. & B. company. Until recently he served as president and engineering expert in

the latter organization. His assistant in the new enterprise, in charge of selling operations, will be Charles A. Mattison, who has been associated with the Pittsfield Spark Coil Co. for the last eighteen years. The company is beginning business with an initial order for 5000 sets of ignition.

Hildebrand Leaves Branch

C. C. Hildebrand, after serving as manager of the Minneapolis branch of the Ford Motor Co., has resigned to take up his residence in Hollywood, Cal., where his family has been living this winter. He will rest for a time before resuming active work. Upon his departure his employees presented him with a platinum set diamond ring and the dealers with a Lincoln car. He was also a guest at a dinner given by the road men. Hildebrand is one of the veterans of the industry. For two years he was associated with the Chalmers company as assistant general manager and for eight years served as sales manager for the Stevens-Duryea. Prior to that he was connected with the bicycle business. He is succeeded by S. A. Stellwagen, formerly manager at Omaha.

Church, Consulting Engineer

H. D. Church of Fairfield, Conn., formerly a chief engineer of the Packard Motor Car Co. and later vice-president of engineering of Hare's Motors, Inc., is now at work in a consulting capacity on several interesting engineering developments. A medium weight six-cylinder model, embodying advanced features of design, was completely developed by Church as vice-president of Hare's. It is understood his present activities include work upon another new light model. His services now are available as consulting engineer.

Marvin at Hot Springs

J. L. Marvin, assistant general manager of the National Automobile Chamber of Commerce, has been prevailed upon to go to Hot Springs, Va., to recuperate from an attack of influenza.

Dawson Assists Campbell

C. E. Dawson, who was formerly sales manager of the Chevrolet Motor Co. of Michigan, has been appointed assistant to Colin Campbell, general sales manager of the Chevrolet Motor Co. M. D. Douglas, previously sales manager at Flint, has been named to succeed Dawson in charge of factory sales activities.

Markle Handles Rickenbacker

Lafayette Markle, formerly identified with Olds, Buick and Studebaker retail sales in Chicago, and later serving as vice-president of the Republic Truck Co. and president of the Oneida Truck Co., has taken over the Rickenbacker franchise in Chicago.

Lagow Represents Hupp

Roger M. Lagow has been appointed factory representative of the Hupp Motor Car Corp. for South and Central America. A graduate of Indiana and Harvard universities, he traveled in Europe for several years before returning to this country as a professor of Romance languages at several colleges. His ability to speak fluently several languages convinced him that his opportunity awaited him in the business field. He has also had a diversified experience in business.

White in Own Company

C. M. White, Jr., for the last four years sales manager of the Firestone Steel Products Co., Akron, has resigned to organize White & Co., Inc., of which he is the president. The company, which will market several lines, including crude rubber, fabric, pigments, etc., and will cover the automobile and rubber trade, will have its headquarters in the Flatiron Building, Akron, and later will establish branches in New York and Chicago. The personnel of the company consists of men well known in the automotive and rubber industries.

A. G. Partridge Joins Goodrich

A. G. Partridge, who resigned recently as vice-president and general sales manager of the Star Rubber Co. of Akron, has been appointed special sales representative for the tire division of the B. F. Goodrich Co. Partridge was for many years vice-president and general sales manager of the Firestone Tire & Rubber Co., resigning a year ago to join the Star organization.

Sherratt in Charge at Pittsburgh

G. F. Sherratt has been appointed manager of the Pittsburgh office of the Chain Belt Co. and will be in charge of all the company's chain and engineering business in that territory.

Neill Goes to Texas

V. H. Day, general sales manager of the General Motors Truck Co., supervised the opening of a new direct factory branch in Dallas, Texas, Saturday. The branch will be under the direction of H. A. Neill, who has been manager of the Philadelphia branch and who recently was connected with the factory sales department. Howard Parks, who has been selling G. M. C. trucks in Texas, will be associated with Neill. Pierre Schon, direct factory wholesale representative in the Southwestern territory, will continue in that position.

G. M. INSURANCE BRANCH

NEW YORK, April 3—The General Exchange Corp., a subsidiary of the General Motors Corp., has been organized to carry fire and theft, liability, property damage and collision insurance for owners of automobiles.

Tire Makers Govern Production by Sales

Will Not Pile Up Inventories of
Finished Goods—60-Day
Supply

AKRON, April 1—Akron tire manufacturers have stopped expanding finished goods inventories, and are applying production direct to sales. Every company in the city has an inventory of about the right balance, with at least a 60-day supply of tires on hand.

In the application of production direct to sales many companies are shipping out tires which are wrapped and loaded in freight cars while still warm. With expansion of inventories no longer necessary, Akron companies are pursuing a "hand-to-mouth" policy, letting production fluctuate and be governed entirely by sales. This is resulting in brief spurts and slumps in tire building, layoffs of men for a few days, and rehiring of these and the employment of many more for brief periods.

Never again, manufacturers say, will they be caught, as they were in 1920, with a huge surplus of tires on hand. Scarcely a company has an inventory exceeding a 60-day tire supply based on normal sales, although a 90-day supply is not considered excessive.

The biggest improvement in the tire industry has been in export trade. For many months a losing proposition for all Akron companies, export business has been re-established upon a profitable basis this year and heavy export orders now are being turned out.

Committee Will Decide Best Course for Parenti

BUFFALO, April 5—A committee representing the creditors of the Parenti Motors Corp. has been formed to decide what will be the best course to pursue with respect to the future of the company. This committee now is studying the situation and will report in a short time.

At the first meeting it was suggested that two courses were open. One would be the appointment of a trustee to take over and adjust the affairs of the company and the other would be an attempt to raise enough money through the sale of cars to enable the company to continue in business. It was stated at the Parenti plant that the company has about 100 cars about 60 per cent completed.

N. A. D. A. APPOINTS SHAW

ST. LOUIS, April 5—Lynn M. Shaw, secretary of the Indiana Automotive Trade Association, has been appointed an assistant general manager of the National Automobile Dealers Association. Prior to his connection with the Indiana organization, Shaw served as secretary of the Youngstown Automobile Dealers Association and previously

RADIO TO TRANSMIT ROAD CONTEST RULES

WASHINGTON, April 5—Messages extending an invitation to all high school pupils to participate in the national essay contest on highway economics will be broadcasted from here to-morrow evening by radio telephone.

The apparatus owned by the Postoffice department will be used in sending out the information as to the rules of the contest, inasmuch as this Federal department acknowledges that delivery of rural mail depends upon the improvement of highways throughout the country.

The contest is under the auspices of the highway and highway transport educational committee.

acted as assistant general manager of the Elton Motors Co., Cadillac distributor for the Youngstown territory.

Holders of Chalmers Notes Form Committee

(Continued from page 784)

to-day that the default in the payment of interest on the first mortgage notes of the Chalmers company, while primarily to conserve working capital, also will have the effect of bringing the actual situation confronting Chalmers to the attention of noteholders and creditors so that some constructive action can be taken.

Notice was given to bankers and creditors, Hutchinson said, of the intention to default payment so that no undue alarm should have been occasioned. He added that the position of the Maxwell Corp. had been set forth clearly. It holds a mortgage of \$3,150,000, which will fall due in October and which Chalmers will not be able to pay under present conditions.

As a preliminary to a refinancing program for Chalmers, the entire situation will be placed before those financially interested in the affairs of the two companies. As a reassurance to Chalmers creditors, Maxwell has agreed to take over all purchase commitments pending a decision on what action shall be taken.

Hutchinson took pains to explain that Maxwell is acting only in the interest of its subsidiary, and that its own financial and manufacturing programs are in no way concerned.

HARLEY CO. SUED ON NOTE

SPRINGFIELD, MASS., April 5—Harry Tatnell of Philadelphia has brought suit against the Harley Co., A. W. Morris of Springfield and R. E. Northway of Natick for a breach of contract. An attachment for \$100,000 on the Harley plant has been filed at the registry of deeds. The basis of the action is alleged non-payment of a note.

Further Price Cuts in Britain Unlikely

Manufacturers Say They Are Doing
Business on Narrow Margin of Profit

WASHINGTON, April 1—No reduction in price of British motor vehicles is expected at the present time, according to reports received by the Automotive Division, Department of Commerce, from the American Trade Commissioner in London. British manufacturers insist that they are still doing business on a narrow margin of profit despite the low cost of labor and raw materials, and therefore cannot cut their selling price. The export trade of the British automotive manufacturers is very small and as its contracts run out no repeat orders are coming in.

There has been a fairly steady continuance of demand for small cars and motorcycles accompanied by virtual stagnation of the large car lines. Manufacturers of motor trucks have been inactive and little improvement is anticipated until the surplus war stocks have been cleared.

Under the new licensing plan purchasers of motor vehicles may take out licenses for one or more quarters of the year. Thus with the lapse of the quarter ending March 31, increased business is expected from purchasers who are not willing to pay the first three months' portion of the pound per horse power per annum tax.

Carter Product Planned to Compete with Ford

WASHINGTON, April 4—The Carter Motor Car Co. reports that while drawings of the car it proposes to make at Hyattsville, Md., have not been completed, it will be designed to compete with Ford.

The company's personnel includes: President, A. G. Carter, for the past 10 years president of the Washington Motor Car Co.; vice-president, H. J. Hogan, formerly with the Lorraine Motor Car Co.; treasurer and general sales manager, Major C. W. Search, formerly with the Jeffries Motor Car Co., and former sales manager of the Northway Motors Co.; general manager, F. L. Carter, formerly treasurer of the Washington Motor Car Co.

NATIONAL AGREEMENT LIKELY

INDIANAPOLIS, April 4—No date has been set as yet for a hearing upon the application filed by the Columbia Axle Co. for the appointment of a receiver for the National Motor Car & Vehicle Corp. It now is considered probable that the application will be withdrawn, inasmuch as a satisfactory agreement is likely between the creditors' committee, which is managing the National factory, and the axle company.

California Reports 70 Per Cent Growth

Truck Sales to Fleet Owners Feature Conditions in Northern Section

SAN FRANCISCO, April 5—Sales of passenger cars for northern California for the first quarter of 1922 are at least 70 per cent better than they were one year ago, and more than 50 per cent better than they were two years ago. Sales of motor trucks to fleet owners, and the establishment of truck fleets in the smaller towns, show nearly 100 per cent gain over the first quarter of 1920, but sales of trucks to individual owners, for their own uses, have not kept pace with fleet sales, and are not more than 50 or 60 per cent better than in the same period of 1920.

Automobile sales in California for February, 1922, were 254 per cent higher than they were for February, 1921. In February of this year the dealers of California sold 8159 cars, while in February, 1921, they disposed of only 3213 cars. The 47 counties of northern California are credited with 3298 sales in February, 1922, as compared with 1310 sales in the same month of 1921. The eleven counties of southern California show 4861 cars sold in February, 1922, against 1903 for February, 1921. Trucks to the number of 1075 were sold in California during February, 1922.

During February, 1922, the registrations for the entire state were 9234, as compared with 6694 in January, 1922, a gain of 2540. In Alameda county, in which is located the city of Oakland, and which holds a high record for automotive vehicle and equipment sales, 656 cars were sold in February of this year, compared with 463 in January, 1922.

Dallas Sales Increase

DALLAS, TEX., April 4—The retail automobile business in Dallas for March was as good as that for January or March, or for the three last months of 1921. Actual sales and deliveries were said to be slightly above those of February, partly because of the influence of the recent spring show.

The truck business was about up to the previous months. The tires and accessories showed some improvement, probably due to the approach of spring and the preparations for using cars which have been housed for a good part of the winter.

The tractor and trailer trade was rather slow, though there were some tractors moving to the farming belts in the Panhandle and the rice sections of southeast Texas.

MERGER RUMORS DENIED

NEW YORK, April 5—The sensational rise of the past few days in automotive stocks has brought numerous rumors in the financial district of impending consolidation. One of these was a revival

IMPROVED BUSINESS REACHES OUT TO MAY

NEW YORK, April 3—The end of March brought no slackening in the business improvement reported in steadily increasing volume by parts manufacturers since Jan. 1. Practically all manufacturers have sufficient orders booked for April to insure a better month than March. Still more gratifying is the fact that many of them have received substantial commitments which will carry them through May.

Early in March there was considerable speculation among parts makers over the prospects after April, but developments in the past two or three weeks have made it certain that there will be no slackening in operations for another two months at least.

The number of parts plants in which operations exceed 50 per cent of capacity is increasing steadily, and a considerable number have been compelled to put on night shifts.

Throughout the parts branch of the industry the moderate optimism which has prevailed for the past three months is approaching a feeling akin to enthusiasm.

of the old report that Mack Trucks, Inc., and the White Co. would combine. Another was that the management of the Pierce-Arrow Motor Car Co. would be taken over by C. W. Nash preparatory to a merger with the Nash Motors Co. Both these reports were emphatically denied.

Springfield Factories Report Better Business

SPRINGFIELD, OHIO, April 4—Orders from France and Australia are being filled at the Springfield works of The International Harvester Co., Charles H. Smart, superintendent, states. The motor truck business is brisk at this plant, good sized orders having been received recently from foreign countries and various points in the United States. The plant is continuing its production schedule of 50 trucks daily. The force has been increased within the last week.

Motor truck business for March at the plant of The Kelly-Springfield Motor Truck Co. was the largest of any month during the past two years, General Manager E. O. O'Donnell says. A gradual improvement in business conditions is noted in reports received by the company from various parts of the United States.

"The first quarter of this year showed an increase of 100 per cent in business over the same period in 1921," said Karl A. Heinzen, advertising manager of The Westcott Motor Car Co., in speaking of the business of this company. "Orders on hand are twice as large as they were at the same time last year."

More Good Reports Received by N.A.C.C.

All Sections of Country Except Dakotas Share in Better Business

NEW YORK, April 6—Directors of the National Automobile Chamber of Commerce, highly gratified at the business done by the industry since Jan. 1, received additional encouraging reports at their monthly meeting here yesterday. These reports were contained in telegrams from distributors in all sections of the country, which stated that business ranged from "good" to "excellent" everywhere except in the Dakotas, where there have been heavy snows.

The manufacturers were told that the used car situation is clearing up rapidly because there is a good demand at the low prices which have been fixed. The decline of prices in the market has been comparable to the reductions in the cost of new cars. The agitation on the subject of used cars has resulted in dealers using greater care in trading, making it possible for them to sell at a profit.

Credit Conditions Easy

Credit conditions are easy everywhere. There appears to be plenty of money for all legitimate enterprises. It was reported that one New York bank believes the present automobile sales season will be the best for two or three years.

While the manufacturers naturally are greatly pleased with the upturn in business, they are not unaware of the fact that the industry now is in the midst of its spring trade and that sales cannot be expected to continue on the present basis after June 1. It is felt, however, that with the present bullish stock market, with general business conditions much better, with exports improving and with foreign exchange rising, business for the last half of year should be good.

The Essex Motor Car Co. was elected to membership in the chamber. It will be represented by Roy D. Chapin.

Alfred H. Swayne and George M. Graham were delegated as counsellors to attend the annual meeting of the Chamber of Commerce of the United States at Washington in May.

The directors sanctioned a meeting of the advertising managers in conjunction with the June convention of the Associated Advertising Clubs of Milwaukee.

J. Walter Drake and General Manager Alfred Reeves will represent the N. A. C. C. at a conference called by Secretary Hoover on April 12 to discuss trade association activities.

The next meeting of the directors will be held in Detroit, May 3.

GREATER FIRESTONE OUTPUT

AKRON, April 5—Announcement is made by the Firestone Tire & Rubber Co. that its production has been increased to 20,000 tires a day compared with 17,000 two months ago.

New European Cars Arriving in Japan

Agencies Giving Up American Products Because of Higher Horsepower Rating

TOKIO, March 2 (*By Mail*)—The approach of the end of the fiscal year has brought several Government departments into the field for new motor transportation. The Electric Bureau of Tokio has just purchased three new repair wagons. These will be mounted on the Packard EC chassis, with full electric equipment and solid tires, and the bodies will be of the modified bus type, capable of carrying 16 mechanics and considerable equipment. The Department of Communications, which is the largest user of motor transportation in Japan—with the exception of the Army—will soon be on the market again.

The local passenger car market remains very depressed. Sales are confined almost entirely to the smallest and lightest of the European light cars, and the popular choice centers on those cars having a taxation rating of less than 10 horsepower. Consequently American cars are not being sold, and agencies for them are being given up. In contrast, every week sees the arrival of some new European car.

German makes are again appearing, and Benz, Mercedes, Protos, Cyclonen and the Austrian Daimler and Fiat are all represented in the Tokio district.

Moline Plow Forecasts Early Reorganization

NEW YORK, April 5—Managers of the reorganization committee of the Moline Plow Co. have addressed a letter to stockholders and creditors explaining the delay in consummating the plan of reorganization. They say that the co-operation of the Willys-Overland Co., which owns 82 per cent of the common stock, could not be obtained because of that company's failure to obtain the consent of its preferred stockholders. The delay of the Willys-Overland was said to be due to pressure of other important matters.

The statement adds that the Willys-Overland Co. has submitted the question to the preferred stockholders, and that the reorganization plan has been recommended by its new board of directors. The managers of the reorganization committee say they feel confident that they "will secure early action in consummating the plan and the proper papers and notices are being prepared to that end."

PYRENE IN NEW PLANT

NEWARK, N. J., April 4—The Pyrene Manufacturing Co., Inc., has moved into its new factory at 520 Belmont Avenue, this city. The building is of thoroughly modern fireproof construction. The general offices formerly located in New York and all manufacturing departments will

REO DELIVERS CARS FOR FOILING BANDITS

LANSING, April 5—The Reo Motor Car Co. has delivered to the Adams Express Co. 14 chrome steel lined cars for its bandit-proof New York delivery service. These cars are the first of an order for 100. The enclosed body has specially closed windows and a windshield which is proof against 45-caliber steel jacketed bullets. Each car has eight portholes for automatic rifles. A lever in the rear makes it possible for a guard to stop the car should the driver be injured. The cars were built after the design of W. M. Barrett, president of the Adams company.

now be located under one roof. To improve, if possible, the service rendered customers, the company has installed a department for the sale of a complete line of safety devices, as well as the long line of fire fighting appliances.

Durant Balance Sheet Shows No Liabilities

NEW YORK, April 5—A balance sheet as of March 31, 1922, issued by Durant Motors, Inc., shows that the company has no liabilities. The principal asset consists of participating contracts amounting to \$20,988,000, representing the company's proportion of earnings of its associate companies valued on a basis of three years net profits conservatively estimated.

Other assets are: furniture, fixtures and equipment, \$44,599; investments and advances to allied companies, \$2,594,130; marketable securities, \$4,225,902; cash, \$3,028,747; notes receivable, \$2,260,543; accounts receivable, \$242,560; materials and supplies, \$108,917. This makes total assets of \$12,505,398, not including the participating contracts.

NEW TEMPLAR SALES MANAGER

CLEVELAND, April 5—Morris Bleiweiss has been named sales manager of the Templar Motor Co. to succeed Paul E. Ryan, who retired from the position on April 1. Bleiweiss went to Templar Motors as assistant factory manager two months after the company started production in 1917. He was promoted to service manager and assistant sales and advertising manager before being named to his present position. Ryan was formerly sales manager for the Aluminum Castings Co. He entered the employ of Templar last May. Templar has increased production since Jan. 1.

WILLS REACHES CAPACITY

DETROIT, April 5—C. H. Wills & Co. will build about 50 Wills Ste. Claire cars daily in April, which will be practically the plant capacity. This is an increase of about 75 per cent over March.

Peru and Australia Have Increased Tax

Former Will Use Revenue for National Defense—Latter for Maintaining Roads

WASHINGTON, April 3—Reports received by the automotive division, Department of Commerce, show that two foreign countries have increased taxes on motor vehicles. This added burden has a tendency to increase the sales resistance for American exporters in Peru and Australia.

Commercial Attache W. E. Dunn advises that the Peruvian Government has raised the ad valorem duty on motor cars 1 per cent when the price does not exceed Lp. 500, and 2 per cent on automobiles and carriages when the price exceeds this amount. In addition, an internal tax will be levied amounting to Lp. 1 for Ford cars for hire, Lp. 2 for other cars for hire and Lp. 5 for private cars, in accordance with a law which was put into effect on Jan. 25, 1922. This tax will be levied only on cars actually in use and but once. The funds obtained from these assessments will be dedicated exclusively to national defense.

The American Trade Commissioner at Melbourne has informed the division that a horse-drawn vehicle tax has been proposed which it is estimated will be assessed upon 200,000 vehicles in the State, and an increased registration tax amounting to 5s per hp. on motor cars, and 2s 6d per hp. on motorcycles.

Show in Mexico City Assured Many Exhibits

MEXICO CITY, MEXICO, March 31 (*By Mail*)—Applications for space reservations for the automobile show which is to be held in the National Theater, here, April 16 to 23, inclusive, are coming in rapidly and already it is assured that the exhibit will far exceed that of the first automobile show given here last year.

It is stated that up to March 18 space had been reserved for displaying thirty different makes of passenger cars. These are principally of American make, but there are three European manufacturers who have secured floor space through their local representatives. The European cars are the Fiat, Mercedes and Renault.

A department has been reserved for trucks and tractors, as was the case last year. These are all of American make. There will be exhibits of lubricants and automobile accessories, but no tires.

FORD VIEWS SUIT LIGHTLY

DETROIT, APRIL 3.—The Ford Motor Co. announces that it does not take seriously the suit filed by Edward S. Huff in Florida to recover \$11,000,000, alleged to be due on magnetos. The Ford company says it knows nothing of Huff.

Makers of Electric Vehicles Hold Show

Cars, Trucks and Equipment Exhibited—New Design Shown of Taxicab

NEW YORK, April 3—The second annual show of electric vehicles and equipment is being held this week at the building of the New York Edison Co., this city. The two branches of the electric vehicle industry are almost completely represented, trucks being shown by seven makers and passenger cars by three. In addition, the show comprises exhibits of storage batteries, battery charging equipment, charging plugs, meters, lubricants and motor wear.

Few New Technical Features

There is not much new in a technical way in either electric trucks or passenger cars. These vehicles have been standardized by the different makers and factory changes are made only at rare intervals. In connection with the trucks the most interesting study is that of the drive employed on the various designs.

With electric propulsion, efficient transmission is of the highest importance, because the radius of operation of the vehicle depends upon it, but the designers evidently do not agree as to which is the most efficient drive, for practically all forms of drive are represented. Steinmetz uses the bevel and spur gear or double reduction drive, and Walker commercial truck the internal gear balanced drive with the driving pinion on the axle shaft in the one case and the armature shaft in the other, and two opposite intermediate gears meshing both with the pinion and the internal gear on the wheel; Ward uses the worm drive; Walter the regular internal gear drive and O-B and Lansden the chain drive.

Among the passenger cars the most recent design is the Electrocar, which is shown in taxicab form. This has the battery carried in an underslung cradle, instead of divided between the seat and the front compartment, as is usually the case in electric passenger cars.

Battery charging outfits for the most part comprise either a motor generator or rectifier and a charging panel. The charging plugs for electric vehicle charging and storage battery charging in general have been standardized.

Electric Trucks to Be Shown

Next week there will be a show of industrial electric trucks at the same building, at which six manufacturers will show trucks and tractors. Material-handling equipment will also be exhibited.

In connection with the show the second annual electric vehicle luncheon was held at the Hotel Astor on April 4. Arthur Williams, president of the New York Edison Co., acted as toast master, and addresses on the use of electric com-

mercial and industrial trucks in various lines of industry were made by Robert Cowie, vice-president of the U. S. Railway Express Co.; F. H. Hotchkiss, who represented Gerson Marks, assistant to the general manager of the N. Y., N. H. & H. R. R., and J. E. Dann, president of the Pilgrim Laundry.

Cowie said that of all the vehicles purchased by his company for the metropolitan district the past year, 83½ per cent were electric vehicles. He had signed orders for no less than 104 such vehicles during the past month. He claimed that owing to the increasing congestion the electric vehicle had all the speed that could be used and that was safe in such a district. Another feature in their favor, he said, was that comparatively small stocks of repair parts sufficed. Cowie mentioned that his company still had in service throughout the country 17,500 horse-drawn vehicles.

FINANCIAL NOTES

Winther Motors, Inc., reports that there is about half of the stock authorized at the time of the consolidation last year issued and outstanding. The company is a result of the consolidation of the Marwin Truck Corp. and the Kenosha Wheel & Axle Co. with the Winther Motor Truck Co. under the name of Winther Motors, Inc. The consolidation was made purely as a matter of convenience and economy in operation. It has an authorized capital stock of \$1,000,000 preferred stock and 600,000 shares of no par value common stock.

Marlin-Rockwell Corp. and subsidiary companies' consolidated balance sheet as of Dec. 31, 1921, shows cash on that date as \$415,883 and, for the previous year, \$544,413. Notes, trade acceptances and other accounts receivable were \$305,832 in 1921 and \$1,065,370 in 1920. Among the liabilities the notes and accounts payable, government taxes, etc., aggregated \$1,783,139 as against \$1,591,342. The earned surplus was \$2,313,862 compared to \$6,862,099.

Black & Decker Mfg. Co. has declared a dividend for the first quarter of the year at the rate of 8 per cent on the preferred stock. The company reports that sales two weeks ago were more than for any week for twenty-two months. It set its sales quota for 1922 \$500,000 higher than its actual sales last year and for the first quarter has made 100 per cent of this quota.

Moon Motor Car Co. directors have declared the regular quarterly dividend of 1½ per cent on preferred stock outstanding, payable April 1, 1922.

PEERLESS ASSETS LARGE

CLEVELAND, April 6—The annual report of the Peerless Truck & Motor Corp. as of Dec. 31 shows current assets of \$7,065,665 against current liabilities of only \$825,682. The surplus at the close of the year was \$5,257,880. The income from sales was \$12,055,904 and the cost of sales was \$12,103,636, leaving a net loss of \$47,742 on this item. The entire net loss for the year was \$103,665.

STEWART-WARNER RE-ELECTS

RICHMOND, VA., April 5—Directors of the Stewart-Warner Speedometer Corp. were re-elected at the annual meeting of stockholders.

BANK CREDITS

Written exclusively for AUTOMOTIVE INDUSTRIES by the Guaranty Trust Co., second largest bank in America.

Last week's advance in call money rates was attributed largely to temporary conditions, such as government withdrawals from local institutions and disbursements of April 1. Call loans covered a range during the week of 4 per cent to 5½ per cent, in comparison with a range of 3½ per cent to 5½ per cent in the previous week. For fixed date maturities little change was noted, and the volume of transactions was small. Sixty and ninety days and four months' maturities were quoted at 4½ per cent, and five and six months' maturities at 4½ per cent to 4¾ per cent, as compared with 4½ per cent for sixty days and 4½ per cent to 4¾ per cent for all other maturities in the previous week. The prime commercial rate remained unchanged at 4½ per cent to 4¾ per cent.

The Federal Reserve statement as of March 29, 1922, showed a decrease of \$1,348,000 in gold reserves and a decrease of \$1,231,000 in total reserves. Total bills on hand increased \$34,691,000 and total earning assets \$33,387,000. There was an increase of \$30,553,000 in total deposits and a decrease of \$1,531,000 in Federal notes in circulation. The reserve ratio decreased from 78.4 per cent to 77.8 per cent.

The following increases were noted in the statement for the New York institution: \$34,198,000 in total reserves; \$17,980,000 in total bills on hand; \$3,818,000 in total earning assets and \$39,596,000 in total deposits. Federal Reserve notes in circulation decreased \$70,000. The ratio of total reserves to deposit and Federal Reserve note liabilities combined, remained unchanged at 86.7 per cent.

The Federal Reserve Bank of Chicago has reduced its rediscount rate on all classes of paper from 5 to 4½ per cent, effective as of March 25.

A decrease in the total number of commercial failures was shown last week as compared with that of the previous week. Dun reports 511 insolvencies last week as compared with 544 in the previous week and 299 during the corresponding week in 1921. Failures decreased in all sections of the country, with the exception of the Pacific Coast, where an increase was noted.

DURANT BUYS TIRE STOCK

AKRON, OHIO, April 5—Frank A. Seiberling, president of the Seiberling Rubber Co., announces that W. C. Durant heads a syndicate of 15 men, each of whom has subscribed for \$50,000 of Seiberling stock on a basis of 40 per cent preferred and 60 per cent common. This completes the Seiberling financing.

EDWARD P. MAGUIRE DIES

HUDSON, MASS., April 4—The death is announced of Edward P. Maguire, general manager of the Lapointe Machine Tool Co. since 1914 and associated with the business for many years before.

INDUSTRIAL NOTES

Republic Rubber Corp. reports, through its receiver, C. H. Booth, that shipments in March to the 25th were 40 per cent greater than for the corresponding February period and that the carry-over into April will be fully 75 per cent greater than from February into March. The company is producing inner tubes at a rate but slightly under the highest rate of output ever attained in its history. The Youngstown plant is operating only in its solid truck tire department but capacity is being approached at the Canton works which will mean the resumption of pneumatic tire production at Youngstown. Pneumatic tire production is in excess of 1,000 a day. None is made except against firm orders, the company declining to stock tires.

Sandvik Steel, Inc., has consolidated its general steel and steel belt conveyor departments in suite 2001, Woolworth Building, New York, with the following executive officers: President and general manager, W. D. Thomas, formerly manager of New York export sales of the American Rolling Mill Co.; vice-president, Anders Johnson, formerly staff engineer, conveyor department, Sandvikens Jernverks Aktiebolag, Sandviken, Sweden; secretary, Garrick M. Spencer; sales manager, Harry Carlson, formerly vice-president and general manager of American Galco, Inc., New York.

Standard Battery Manufacturing Co., Fort Worth, Texas, reports a daily output of more than 100 batteries with the plant facilities increased for a production of 200. There are 50 men employed. The company started in 1918 with two men on the payroll and an output of two batteries a day. In 1921 the business transacted amounted to \$260,000 and this year is expected to reach \$375,000. Four years ago the company had less than a dozen selling agents. It now has approximately 400 in a dozen states and old Mexico.

Dickinson Cord Tire Corp. has entered the field with a cord tire machine perfected by F. S. Dickinson, veteran in the industry. Every cord is laid by a machine, the cords then being laid in strip units, comprised of several separate cords. Each strip is so graduated as to compensate for the variable circumference between the bead and the crown of the casing, so that the full area is covered. These strips are laid in the path representing the shortest distance between the two beads.

C. A. Shaler Co. patents covering solid fuel vulcanizers have again been upheld by Judge Page in the United States District Court, Minnesota district, in a suit brought against Loren Risk and others, doing business as Risk's Riskless Vulcanizer Co. These patents have been in litigation for several years in various districts, there being at one time, it is stated, as many as thirty-five infringements on the market.

Bearing Service Co. has opened its second branch in Canada at Winnipeg, Man., using this point to cover the western section of the dominion. W. L. Spain, formerly associated with the Chevrolet Motor Co. as its district manager, is in charge. The company maintains a branch at Toronto but the growing use of motor vehicles in Canada has made western expansion necessary.

Detroit Seamless Steel Tubes Co. has established a branch sales office in the Canadian Pacific Building, New York City. H. C. Kensing, formerly manager of the steel tubing department of the Hungerford Brass & Copper Co. at the latter company's metro-

politan branch, has been appointed district sales manager for the New York territory.

Isotta Motors, Inc., New York City, has been appointed the agent for the United States of the Isotta-Fraschini products. U. V. D'Annunzio is president of the company and Ede Paoli, associated for more than three years with the Fiat Co., is the commercial manager.

National Association of Farm Equipment Manufacturers has moved its offices from 72 West Adams Street, Chicago, to the Transportation Building, 608 South Dearborn Street, that city.

Urbana Tool & Die Co., Urbana, Ohio, has completed arrangements with W. C. Straub, manufacturer's agent, to represent it in the Cleveland district.

Disteel Wheel Corp. announces that its New York sales room and service station are now combined at 189 Academy Street, Long Island City.

Unemployed Engineers Are Aided by Bureau

NEW YORK, April 3—The Federated American Engineering Societies number among its activities a free employment bureau maintained at 29 West Thirty-ninth Street for the purpose of relieving unemployment among engineers. The organization includes the American Institute of Mining and Metallurgical Engineers, American Society of Mechanical Engineers, American Institute of Electrical Engineers, and twenty-seven other associations throughout the country, its aggregate membership being 50,000 professional engineers.

In 1920 the bureau placed 69 per cent of the 2300 applicants for employment, and last year positions were obtained for 71.5 per cent. Complete statement of the qualifications wished for are requested from employers while similar thoroughness is required from the applicant, who must be a member of an affiliated association. During the industrial depression the bureau carried on an intensive campaign in Greater New York and New Jersey. W. V. Brown is manager of the bureau.

FREIGHT RATES REDUCED

SAN FRANCISCO, April 3—Substantial reductions in transcontinental freight rates are announced by all the cross-continent lines having terminals here and in Oakland, on a number of articles, chief among which is automobiles. Reductions range from 10 to 30 per cent on automobiles from Chicago to the coast, the 30 per cent reduction being in force on cars sent here for trans-shipment to steamers for export.

SHOW STIMULATES SALES

YOUNGSTOWN, OHIO, March 31.—The Youngstown automobile show gave marked impetus to the sale of motor cars in this city. Actual sales at the show numbered 128 cars, of which only 36 were trade-ins. The value of the cars sold was \$208,640. Dealers report an average of three or four sales a week since the show to prospects obtained at that time.

METAL MARKETS

So far there has been no buying of a sufficiently representative character to warrant the statement that the market for sheets is established at the higher asking prices which a number of independent producers proclaimed effective April 1. When Judge Gary made the statement the other day that the Corporation was disposed to follow the lead of the independents in an equitable upward revision of prices he took pains to make it plain that the independents must not merely secure publication of higher quotations in the newspapers but that they must actually book orders for representative tonnages at higher prices before they can lay claim to a market leadership that will inspire others to follow.

In the course of the next few weeks it should become apparent whether the momentum of demand has become sufficiently strong to overcome the resistance which many consumers offer at this time to higher prices or whether these higher prices will slowly vanish amid the apathy of buyers. Whether the contention of steel producers that the prices which have prevailed so far were inadequate and in some instances below cost is correct or not, will have precious little to do with settling the fate of the new prices. Validity of the latter will depend solely upon the demand over the next few months. If this demand should turn out to be sufficient to support the higher prices, it is highly improbable that the movement will stop there. Quite a few steel consuming industries which have been out of the market for some time are resuming purchases on a modest scale and the greater diversity of the demand will be magnified and resorted to as a handy prop for ascending prices.

In many quarters developments during the last few weeks have created an impression that the advent of the year's second quarter marks the end of one phase of the post-war deflation movement and that the steel market is merely leading in the natural reaction that has now begun to set in and which those who hold this view believe will eventually spread to other commodity markets. Attempts to lift the steel market to higher levels have not been confined to sheets; automotive consumers of hot-rolled strip steel who a few weeks ago had no trouble in covering their requirements at 1.75¢ are now being asked 1.90¢, base Pittsburgh level.

Pig Iron.—Automotive foundries are buying foundry and malleable in a routine way. Sellers contend that the trend is upward but admit that the immediate future may bring a temporary halt in buying.

Steel.—Higher asking prices have become general for nearly all steel products but no transactions worthy of note have so far been consummated at these higher levels. Steel bars came in for impressive demand at the 1.40¢ price level; no business at 1.50¢ has been done so far. The last actual business in sheet bars for which up to \$31. Pittsburgh, is now asked was at a fraction better than \$29. Bolt and nut prices are stiffening.

Aluminum.—The market is fairly active with 17.50¢ seemingly the inside quotation for 98 to 99 per cent pure virgin ingots. Importers and dealers have their ears to the ground for advance news regarding the fate of aluminum in the tariff bill, but consumers are apparently not disposed to stock up even though they believe that the rate of duty will be raised considerably.

Copper.—Semi-speculative holders are taking on additional tonnages when price warrants.

Calendar

SHOWS

April 8-16—New York, Second Annual Electric Automobile Show, Showroom of the New York Edison Co.

FOREIGN SHOWS

March 10-July 31—Tokio, Japan, Peace Exhibition.

April 16-23—Mexico City, Annual Automobile Show, Auspices of the Automotive Division of the American Chamber of Commerce.

April 22-May 1—Prague, Czechoslovakia, Fourteenth International Automobile Exhibition.

May—Shanghai, Exhibition of Road Building Material.

May, 1922—Quito, Ecuador, Agricultural Exposition, celebrating Centenary of Ecuador. Automotive Section.

May 1-15—The Hague, Automobile Show, also Airplanes and Motorboats. Secretary, Spui 185, The Hague.

May 6-21—Scheveningen, Automobile Show.

May 24-June 5—Barcelona, Spain, Automobile Show under Dealers' Direction.

May 28-June 5—Prague, Motor Show, Hotel de Ville.

July 1-24—London (Olympia), Aircraft Exhibition.

Sept. 1922—Rio de Janeiro, Brazil, Automobile exhibition in connection with the Brazilian Centenary Association. Automobilista Brasileira.

Sept. 15-20—The Hague, Automobile Show.

September—Buenos Aires, Argentina, Annual Exhibition, Sociedad Rural Argentina.

Oct. 12-23—London (Olympia), International Commercial Vehicle Exhibition.

November—London (Olympia), Automobile Show.

Nov. 10-Dec. 19—Brussels, Automobile Show, Palais de la Cinquantenaire.

Nov. 29-Dec. 4—London (Olympia), Cycle and Motorcycle Show, British Cycle Motors, The Tower, Warwick Road, Coventry.

November—Buenos Aires, Argentina, Annual Exhibition, Automovil Club Argentino.

CONVENTIONS

April 20-22—Buffalo, N. Y., Sixth Annual Convention of the American Gear Manufacturers Association.

May 8-10—New York, National Association of Manufacturers.

May 10-12—Philadelphia, Ninth National Foreign Trade Convention of the National Foreign Trade Council.

May 12—New York, Annual Meeting, National Highway Traffic Association, at the Automobile Club of America.

May 16-18—Washington, D. C., Annual Meeting of the Chamber of Commerce of the United States.

May 22-25—New York, Palisades Interstate Park, Second National Conference on State Parks, Bear Mountain Inn.

June 11-15—Milwaukee, Annual International Convention of the Associated Advertising Clubs of the World.

June 19-24—Colorado Springs, Summer Meeting, Automotive Equipment Association.

June 26-July 1—Atlantic City, Twenty-fifth Annual Meeting of the American Society for Testing Materials, Chalfonte-Haddon Hall Hotel.

August 28-Sept. 2—Detroit, National Safety Congress.

Sept. 18-23, 1922—Rome, Italy, Second Annual Meeting of the International Chamber of Commerce.

S. A. E. MEETINGS

Detroit, April 28, May 26.

June 20-24—White Sulphur Springs, W. Va., 1922 Summer meeting of Society of Automotive Engineers.

Willys-Overland Co. Takes 1921 Losses

NEW YORK, April 6—The Willys-Overland Co. is another of those in the automotive field which has taken its losses and is now in a position to go ahead on a profit-making basis. Its business, which has been excellent for several months, still is moving upward.

Net Loss was \$8,633,279

A detailed report for the year 1921 shows a deficit of \$23,560,389, after inventory adjustment, interest, depreciation and other charges. Its net loss after all expenses was \$8,633,279, as compared with earnings of \$8,822,152 in 1920. To this loss has been added \$1,742,653 for interest; \$2,130,169 for depreciation, etc.; \$733,922 for tool replacement and \$10,320,364 for other adjustments. This compares with a total deficit of \$5,480,394 for 1920.

It is explained that in computing the net loss, all expenses, including reduction in price of cars, idle plant expenses, adjustment of inventory values and other extraordinary expenses, have been included. It also is explained that the other adjustments mentioned include \$7,412,275 for reduction in value of investments in affiliated companies, \$759,468 for additional losses on commitments and \$2,148,621 for reduction in value of tools, dies, jigs and patterns.

Inventories Reduced

The statement of assets shows that inventories stand at \$17,696,814 as compared with \$35,309,825 on Dec. 31, 1921. Other current assets are: Accounts receivable \$1,545,505; notes receivable \$806,221; cash \$5,128,403.

The two largest items of current liabilities are notes and bills payable amounting to \$18,479,625 and accounts payable amounting to \$2,770,262. Arrangements have been practically com-

pleted for taking care of the bank loans which approximate \$16,000,000. With these obligations deducted, the company could pay all its current obligations with the cash on hand and still have a balance.

G. M. STOCK ENHANCED

NEW YORK, April 6—The rapid advance in the price of common stock of the General Motors Corp. on the stock exchange added \$51,376,475 to the book value of the stock outstanding from the close of business last Tuesday to the close of business last night. The holdings of the duPont interests increased in value in this period \$18,750,000. Their holdings amount to 7,500,000 shares.

GEAR MAKERS TO MEET

BUFFALO, April 6—The annual meeting of the American Gear Manufacturers Association will be held at the Lafayette Hotel, here, April 20, 21 and 22. The program will give special emphasis to business conditions in the gear industry and the outlook for the immediate future. Reports will be made by committees on standardization.

GRUBB, VICTOR SALES HEAD

SPRINGFIELD, OHIO, April 5—H. A. Grubb, formerly with the Star Rubber Co., Akron, was to-day appointed general sales manager of the Victor Rubber Co., succeeding C. A. Swinehart who resigned. Grubb takes charge at once. Swinehart has been sales head of the Victor company for many years.

MONITOR MOTORS SUED

COLUMBUS, April 5—Suit to collect \$29,051 has been filed against the Monitor Motor Co. and Ernest W. Pavey, receiver of the company, by Herschell-Spillman Co. of North Tonawanda, N. Y. The petition alleges that the defendant failed to keep a contract entered into for 1000 engines. In all only 42 engines were accepted.

Coal Strike Affects Motor Vehicle Sales

ALLENTOWN, PA., April 5—This city, on the outskirts of the anthracite coal region, is beginning to feel the effects of the strike, and reports in automotive circles indicate that curtailment of business is much more drastic in trade centers actually in the coal zone.

Here in Allentown, buying of cars and trucks for immediate delivery has slowed up considerably. Dealers are slowed up in making sales and most of the orders, while accompanied by deposits in the regular way, are for delivery "when the strike ends."

Reports of New Gasoline Methods Boost Stocks

NEW YORK, April 6—Sharp advances in the quotations on the stocks of two companies have followed reports in the last few days that they have evolved processes for lowering the cost of operating motor vehicles. One of these corporations is the Davison Chemical Co., which, it is reported, soon will announce a new method of extracting gasoline from crude oil. The other is the Barnsdall Corp., which is reported to have perfected a new fuel for gasoline engines to be called "super gas" and which will sell for 7 cents or 8 cents a gallon.

Committees representing the Society of Automotive Engineers and the National Automobile Chamber of Commerce are reported to have been impressed with the new Greenstreet cracking process for extracting gas from crude oil.

FORD ASSEMBLING AT CHICAGO

CHICAGO, April 3—The Ford assembly plant here started at capacity production of 240 cars a day April 1. A. W. L. Gilpin, sales manager, announces that the number of cars turned out under the 5-day week will be slightly over the average.

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Good Business for Rest of Year Seems Assured

Sales in all branches of industry large. Country recovering from depression. Repetition of 1920 slump improbable. Higher prices for farm products chief factor in recovery. Large farm market for low priced cars and small trucks. Parts sales large.

By James C. Dalton

BUSINESS is so good in the automotive industry that most of the people engaged in it are going around with their fingers crossed. It seems almost too good to be true and they're afraid they'll wake up to find it a beautiful dream. The transition has been almost as sudden and startling as the sun breaking through the clouds after an April shower, bringing a rainbow with it.

Even now, with a wonderful March business behind them, many manufacturers and dealers are supplementing their statements—in private—with the observation that it "may be only a flash in the pan."

It isn't.

The automotive industry has emerged definitely from the long period of depression. Many tangles remain to be straightened out and there are many problems to be solved, but business will be good for some time to come.

There are seasonal declines in the sale of motor vehicles just as in most other industries and the sales curve will not always move upward, but a period of years will elapse before it gets another such jolt as it did in 1920. If the industry has learned its lesson there may never be another such sickening loop-the-loop from the peak of prosperity to the slough of despond.

An astounding improvement in general business

conditions in the United States has come in the last eight weeks. At the end of January it seemed that little progress had been made on the road to recovery. Then the wind changed, almost over night, and confidence was rolled up like a giant snow ball.

Confidence was all that was lacking. It hasn't come back in normal measure and most people still are hesitant, but they have ceased to shy at every shadow and they are not looking constantly for ghostly manifestations by evil spirits.

AUTOMOTIVE INDUSTRIES made the following prediction in its issue of Dec. 29, 1921:

"So far as passenger cars are concerned, the first quarter of 1922 will be materially better than the corresponding quarter this year; the second quarter a little better than in 1921, the third not quite so good, and the fourth considerably better. The truck market will improve with general business."

The first quarter of 1922 is history and it more than came up to expectations. There need be little hesitancy in saying now that the second quarter will do the same. April is certain to be at least as good a month as March, which was the best in two full years. It is practically assured that May will equal the volume of April and there need be little doubt about June.

Beyond June the outlook is somewhat obscure. It would not be surprising if July brought the midsum-

mer slump which has been perennial with the industry except in 1920 and 1921. Conditions last year were abnormal. Beginning with March, sales and production ran along on practically an even keel for eight months. There was no sharp falling off in the middle of the summer. In fact, the third quarter was a trifle better than the second. That condition may prevail again this year, but if it does it will be a distinct surprise.

In 1920 March was the biggest month of the year with shipments of 29,336 carloads and 57,273 driveaways. April brought a sharp slump with only 17,147 carloads but 64,634 driveaways. Part of the decline in shipments was due, however, to a shortage of freight cars. Shipments for the second quarter as a whole were not as large as in the third quarter.

Volume of Truck Sales Will Increase

The last quarter both in 1920 and 1921 showed a very marked falling off. The reverse is likely to be true this year. It would not be in any sense surprising if October, November and December brought a larger total of sales than the three preceding months. There is certain to be throughout the country a strong demand for enclosed passenger cars and the farm markets probably will be stronger than at any time during the year, especially in the South. So far as the agricultural districts are concerned, truck sales will increase in volume as the year progresses, probably reaching their peak at harvest time in the various zones, or immediately afterwards.

Considering all the factors involved, the automotive industry can safely view the remainder of 1922 with serenity. So far as passenger cars are concerned, the volume assuredly will be as large as last year and in all probability larger. The number of light trucks sold will be two or three times as large and in the heavy duty field last year's sales record undoubtedly will be doubled. The parts and accessory manufacturers can count on business at least double the aggregate of 1921 and in all probability much more than that.

While it is conservative to say that business in 1922 will be good for the industry as a whole, this is no time to take the brakes off and disregard caution. After the lesson of 1920 it is not likely any manufacturers will go very far in piling up an inventory. The same should be true in respect to surplus stocks of completed vehicles. Manufacture should be held closely to sales demand. The industry has plenty of factory space for a long time to come.

It probably will be at least a year before the industry is sufficiently stabilized to expect the placing of commitments for supplies for more than a month or two in advance.

Reasons for Prosperity's Return

The fundamental reasons for the return of prosperity and confidence are not hard to find. They were:

Higher prices for farm products, more cash and more buying in agricultural districts.

A general increase of operations in industrial centers and less unemployment.

This tells the whole epic story of the transformation from deep depression to comparative prosperity. The country as a whole is not yet out of the woods, but it is coming through. Conditions are vastly better than they were a year ago.

Higher prices for farm products, such as grain and cotton, wrought the change. There was an immediate increase in the purchasing power of the farmers who constitute half the entire purchasing power of the country. This reached back to the mills and factories which took on additional workers. When these operatives went back to work they began purchasing goods at retail.

This brought more orders to the wholesalers which went back to the producers.

Thus the circle was completed. It was another demonstration of the time honored economic law that there can be no general prosperity when any one great section of the population is not prosperous.

In reporting the agricultural conference at Washington in its Feb. 2 issue, AUTOMOTIVE INDUSTRIES said:

"Motor truck manufacturers who study, analyze and develop farm markets will be the ones who will reap the rewards in the near future."

That prediction, improbable of fulfillment as it seemed at that time, was fully vindicated in less than six weeks.

Watch those farmers! They're coming back. They felt for two years with considerable reason that they weren't getting a square deal. They accused the whole world of skulduggery against them. They couldn't get enough out of their crops to pay the cost of raising them. They owed money to everybody who'd trust them. Their creditors needed the money. In a good many cases they were having a terrible time to keep three jumps ahead of the sheriff.

The farmer hates debt. It hurts his pride not to be able to meet his notes when they're due. He prides himself on his honesty. When he sold some wheat or corn or hogs he dragged the old automobile out of the barn, shuddered at the way it rattled and the engine knocked, pumped a little air into the decrepit tires, climbed into the driver's seat and called his wife to go along with him. He drove to town and stopped at the village bank. Then he dug his lean looking roll out of his pocket and went in to whittle down the notes again.

While the head of the family was paying for a fraction of the "dead horse," which might represent the seed he bought in the spring, his wife was window shopping. She was looking longingly at the gingham and the dresses and the millinery. Looking was all she could afford. If she bought anything it was a pair of cotton stockings or something she couldn't get along without. Maybe they took home a bag of peanuts or candy for the kiddies. That was all except the canceled note.

The Tide Turns

Then the tide began to turn, as tides always do. With the exception of tobacco every agricultural product for which prices are given in the "Survey of Current Business" issued by the Department of Commerce, showed a substantial increase in February over January. Compared with December, the improvement is still more marked. The price of hogs in Chicago increased 45 per cent in two months. Sheep and lambs increased from 40 per cent to 70 per cent. Wheat and corn each rose about 20 per cent. Wool went up to 28 per cent while cattle and the minor cereals showed substantial gains.

Although cotton is slightly higher than in January, it is below the price reached in the last quarter of 1921. While February was a shorter month than January, the daily average consumption of cotton in the mills was about the same. Compared with a year ago, there was an increase of 20 per cent in consumption notwithstanding the widespread labor troubles in New England mills.

There were fluctuations in March in the prices for farm products, but on the whole they were high enough to take a good share of the gloom out of the farmer's heart. He always is happier in the spring, anyway, when he can get at his planting. But he is a lot more cheerful this spring than he was last. It begins to look to him as though the worst was over, that he will be able to pay his debts and have a little left to buy some of the things he wants but doesn't actually have to get.

Among the things the farmer wants more than any-

thing else are inexpensive motor cars and light trucks. He's going to have them if he can. A questionnaire sent recently to a large number of farmers in Washington, Oregon and Idaho brought the information that more of them proposed to buy motor vehicles than anything else except supplies needed for agricultural operations. This situation is typical.

After two long lean years the men in the rural districts who deal in motor vehicles, equipment, accessories and service, are going to find their business very much better in 1922. In fact, they may be better off than their city brothers.

The Farmer Is Going to Buy

The average farmer is going to buy something, at least, from them. And not all farmers are average. Thousands of them have money in the bank and there are many sections where they have been making some money right along. They have been disgusted at general conditions, however, and have refused to buy on general principles. Now they are convinced that the farmer is coming into his own and they are ready to go into the market.

But they must be SOLD the goods they want. It won't be enough to sit on the front porch and wait for them to come along. The merchant who does business with them has got to work and work hard. They will buy where they think they can get the most for their money.

It will pay to cultivate the farmers this year. Even in the Dakotas where they are poorer than almost anywhere else, there are prospects in every district. If the automobile dealer or service man will dig them out he can sell them something. From an automotive point of view 1922 won't be the best year on record in the agricultural sections, but it will be so much better than the last two have been that it will seem like genuine prosperity. Business will get better steadily as the year advances, reaching the peak at harvest time.

In selling automotive equipment to the farmer it isn't necessary to sell him on the value and utility of motor vehicles. He's sold already. All he needs is the cash or credit to buy them. He will think several times before he'll buy a passenger car on credit, but if he can be shown that a light truck will lower his marketing costs and increase his profits, he will buy one on time.

Trucks of one-half, three-quarters and one ton capacity are going to be mighty good bets in the rural communities, and it wouldn't be surprising if more money were made on them this year than on passenger cars. That's a market every dealer should study earnestly.

The villages of the country, except those which are close to big centers of population, are mainly dependent on the farms for their prosperity. As the farm market grows, their business expands. Even the doctors and dentists and lawyers in these towns have had to take notes from their farm patrons the last two years. With the payments made on these notes, they will be likely to buy the motor cars or equipment they need.

With the village merchant selling more goods, he'll have to order more freely from the city wholesaler or jobber. These orders will move back to the mills and there will be more work in the factory towns.

For example, when a few farmers in North Dakota sell their goods at what they think is a fair price, they may decide to buy sewing machines for their wives. If they do, it may be a big help to Elizabeth, N. J.

It is easy to see, therefore, that the automotive dealer in every part of the country is going to be helped by higher prices for wheat or pigs or eggs.

The United States has gone far in its readjustment from a war to a peace basis. That readjustment never can be finished completely until the rest of the world gets back to par, as it were. A long time must elapse before that much to be desired condition can be achieved, but steady progress is being made in that direction, and it is more rapid than appears on the surface.

Full prosperity never can be restored in this country until foreign countries can absorb the surplus of raw materials and manufactured products which the United States can produce. That makes all the difference in the world so far as profits are concerned. But the export market is improving rapidly. The American manufacturer of motor vehicles and equipment who is going after export business intelligently is getting it. The increase in the value of the British pound sterling has helped amazingly.

A lot of things remain to be done in this country before normal conditions can be entirely restored. Some of them are:

Sane revision of the tax system.

Reduction of governmental expenditures.

Permanent settlement of the tariff on a sane basis.

Reorganization of Federal machinery so it will give more efficient service.

The refunding of foreign loans so they can be reduced gradually.

Assistance to exporters and the safeguarding of foreign commerce.

Assistance to the farmers through supplements to the normal banking machinery and by the mobilization of private credit to finance cotton, cattle and other commodities.

Development of water power resources and the elimination of waste in production and distribution.

Legislation never can be a panacea for economic ills, but wise action by Congress will do much to solve some of these pressing problems.

The business world already has done much to right itself and the readjustment has come about with less disturbance than might have been expected. There has been no actual money panic, as there would have been except for the Federal Reserve system and as there always has been in previous periods of great depression.

Automotive Industry Fortunate

So far as the automotive industry is concerned, it has been exceedingly fortunate. The percentage of casualties has been relatively light. Failures there have been, but they have been comparatively small and they have not shaken the structure of the industry. Last year was the third best the industry ever has had and this year will be fully as good. It will be considerably better except, perhaps, in the sale of passenger cars. The total in that field is not likely to go much ahead of last year, but it must not be forgotten that more than 1,500,000 cars were sold in 1921.

CONSIDERING all the factors involved, the automotive industry can safely view the remainder of 1922 with serenity. So far as passenger cars are concerned, the volume assuredly will be as large as last year and in all probability larger. The number of light trucks sold will be two or three times as large and in the heavy duty field last year's sales record undoubtedly will be doubled. The parts and accessory manufacturers can count on business at least double the aggregate of 1921 and in all probability much more than that.

Factories are co-operating with dealers as they never did before. They are considering the questions of finances, used cars, service and satisfied customers. They are thinking in terms of quality and their engineers are working on mechanical improvements. Greater mileage per gallon of gasoline and lower maintenance costs for motor vehicles have become mighty big factors. Keen competition is a business stimulant.

Manufacturers are competing for competent dealers. They are glad to make contract concessions to get the right men, and they are looking at the vital problems of the industry in a broader way. They realize that all its component parts must be prosperous and happy if it is to be happy and prosperous as a whole.

Builders of motor vehicles have liquidated their inventories and taken their losses, staggering as they have been in some cases. They have done everything possible to lower production costs and overhead expenses. The consequence has been that they have been able to make drastic price reductions. These reductions have been passed on to the ultimate purchasers and they have not been absorbed by the middleman as they have been in

most other industries. As a result purchasers have no grievance. Even the farmers admit automobile makers have been fair on the question of prices.

Prices seem to have been fairly well stabilized in the passenger car field, although reductions may be expected here and there throughout the year. Truck and tractor makers have brought their prices down as sales have felt the stimulus of improved business conditions generally and competition has forced them to act.

The hearts of the great basic industries are throbbing with a stronger beat. Idle freight cars are rapidly decreasing in number. Bank vaults are bulging with funds awaiting investment in sound enterprises. Interest rates are going lower all the time. The nation finally has conceded that motor vehicles are essential to its life and that even passenger cars are not "pleasure" vehicles.

There are a few clouds left on the automotive horizon, but the sun has broken through and there are big patches of blue sky. The automotive merchant who whistles as he works and who works hard will have a good year and when he balances his books at the end of December he will find he has prospered.

Bristol Gas Starter for Multi-Cylinder Aircraft Engines

THE Bristol gas starter, designed for starting aircraft engines of six or more cylinders up to 500 hp., is a product of the well-known British aircraft manufacturing concern. It may be operated from inside the fuselage and during flight, may be installed in any convenient position, away from the engine if necessary, and weighs only 40 lbs. Inasmuch as the hand magneto and dope pump required when no motor type of starter is fitted are dispensed with, it is claimed that there is really a saving in weight.

The starter consists of a small air-cooled single cylinder two-stroke engine, and a pumping cylinder. The latter draws combustible mixture from the carbureter, supplying the two-stroke power cylinder, and pumps the mixture under pressure to the main engine cylinders.

Interposed between the pumping cylinder and the main engine cylinders is a small disc valve distributor, driven by suitable gearing from the main engine, at one half engine speed, and which passes the compressed gas to each cylinder:

- (1) When on its firing stroke.
- (2) When on a portion of its induction stroke.

To avoid loss of pressure through the open inlet valves on the induction stroke, the port in the distributor in communication at this period is controlled by a spring loaded ball valve, arranged to open at about 40 lbs. pressure. A non-return valve is fitted to each cylinder, which effectively isolates the starting apparatus when the main engine is running.

The gas starter is fitted with a two-cylinder magneto, from which one ignition lead is taken to the spark plug of the two-stroke power cylinder, while the second lead is taken to the central terminal of the distributor on one of the main engine magnetos.

Method of Operation

The two-stroke engine is started by means of the lever provided, and under the pressure of gas supplied to the cylinders the main engine begins to turn. At the same time gas is admitted into the cylinders during the period of the induction stroke, this gas passing through the cylinders and open inlet valves, and filling the induction

system. After one complete revolution, therefore, the whole induction system is filled with gas, which is drawn in on the next induction stroke, and by opening the short circuit switch between the starter magneto and main engine magneto, the engine will fire and pick up on its own carbureters. It will thus be seen that the gas starter supplies both gasoline and ignition to the main engine for starting. It is claimed that engines up to 500 hp. when cold are turned round at the rate of 12-15 r.p.m. The induction pipe of the gas starter is so arranged that the pumping cylinder gets a richer mixture than the power cylinder, which is necessary on account of the subsequent dilution when the mixture reaches the main engine cylinders.

Construction

Both power and pump pistons are of aluminum, of 3 in. diameter and a stroke of $2\frac{1}{2}$ in. The big ends of the connecting rods are mounted on roller bearings, and are located side by side on one common crank pin.

The cast-iron power cylinder is of the three port type, the crankcase being used to compress the mixture. The cast-iron pump cylinder draws its mixture through a port uncovered by the piston as it reaches the bottom of its stroke, and discharges through a non-return valve in the head.

The crankshaft is in two parts with integral balance weights, and is mounted on ball bearings. From one end the two-cylinder magneto is driven direct, while the fly-wheel and starting gear are carried on the other end.

The starting gear consists of a quadrant attached to the starting lever, which is brought into mesh with the pinion connected through a free wheel to the fly-wheel. When not in use, the quadrant is entirely out of mesh with the pinion.

A cast-iron fan fly-wheel is fitted, with integral blades, which deliver air to the power cylinder at sufficient velocity to enable the engine to be run continuously under full throttle.

The fly-wheel is also provided with a Vee belt rim which may be used for driving auxiliaries. The "petrol" system of lubrication is used (oil mixed with fuel).

Trend of French Cycle Cars and Light Cars

Heavy taxes on cars with piston displacement of more than 67 cu. in. and weighing over 770 pounds has revived interest in cycle cars. Industry tends toward the four-cylinder, water-cooled type, with standard transmission and drive. Description of leading French cycle and light cars.

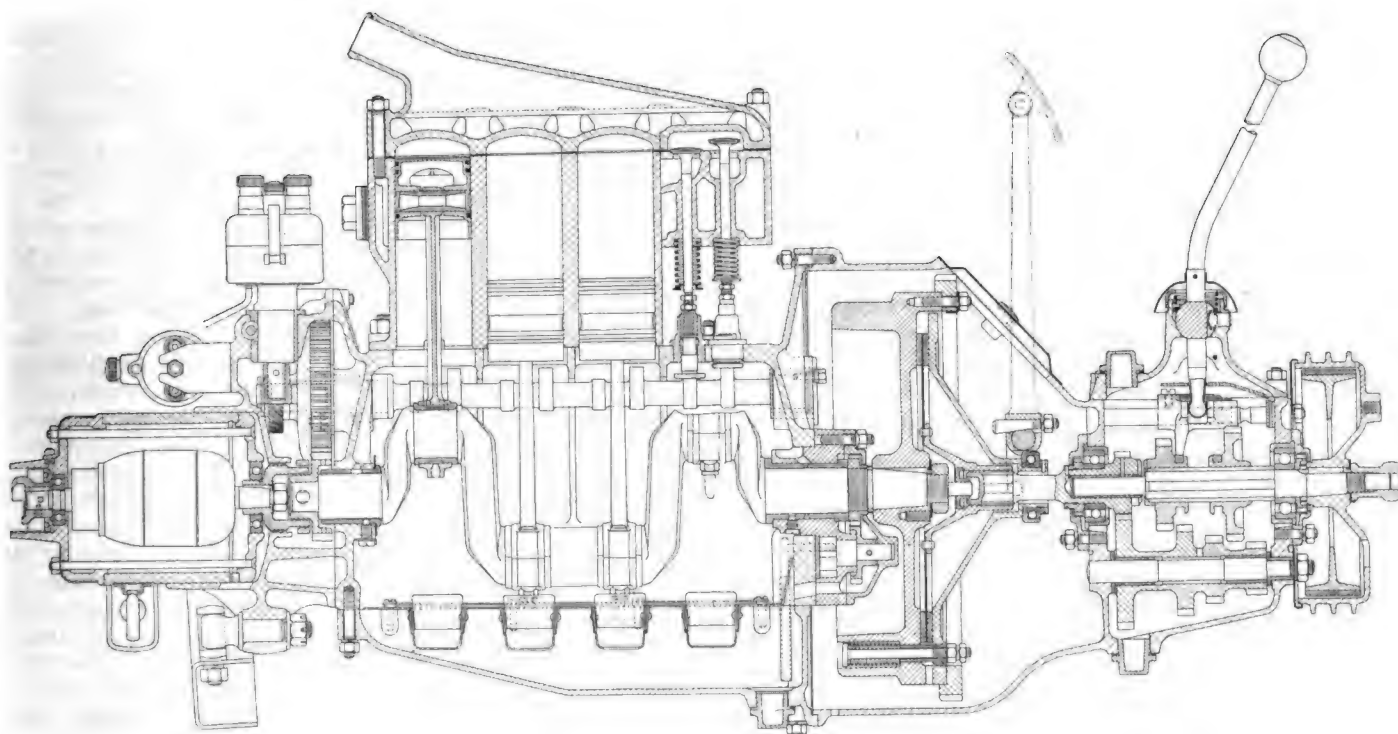
By W. F. Bradley

FRANCE, in common with other European countries, is interested in the development of light two-seater automobiles commonly designed as cycle cars. This term does not imply the adoption of any specific mechanical features, for under the French Government definition any two-seater automobile with a piston displacement not exceeding 67 cu. in. and weighing not more than 770 lb. is a cycle car and entitled to the benefit of the reduced tax of 100 francs per annum. Unless coming within these two limits, the machine is classed as an automobile and pays higher taxes, varying according to district, but certainly not less than 400 francs.

The decision of the Government to give special treatment to 67 cu. in. 770-lb. machines has been responsible for a wonderful revival in cycle car production. French engineers, however, are not showing much interest in pure cycle cars, that is, in light three and four-wheelers having more of the characteristics of the motor cycle than of the automobile. By a pure cycle car is meant a machine with an air-cooled engine with less than four cylinders, a simplified type of change-speed mechanism, and chain or belt drive.

In England considerable importance is being attached to air cooling for small powerplants. In France the tendency is entirely in the opposite direction. Other Continental countries—Italy, Belgium, Austria, Germany—are also showing a preference for water cooling. There is not a single maker of any standing in France who has preferred air-cooled to a water-cooled engine, even when he has to keep his piston displacement down to 67 cu. in. and is limited to a total weight of 770 lb.

The line of thought of the French engineers is that as piston displacement is decreased thermal and mechanical efficiency must be increased. It is an easier task to produce a 67 cu. in. high-speed high-efficiency water-cooled engine than an air-cooled powerplant of the same size. With air cooling the compression must be kept lower to avoid pre-ignition and spark plug troubles. The air-cooled engine will need decarbonizing at more frequent intervals and it will be more difficult to keep in tune. Its oil consumption will be higher, and this is an important matter when a good oil costs at least 5 francs per litre. To obtain good cooling the engine will have to be either a V or horizontal opposed. If four cylinders are adopted, there must



Sectional view of Citroen 5-hp. power plant. Cylinder dimensions, 2.2 by 3.5-in.

be some system of blower to direct a draft of air on the cylinder heads; this absorbs considerable power and complicates the design. While a twin-cylinder air-cooled engine with a simplified type of transmission is attractive from a cheap production point of view, the French industry is pinning its faith on a more elaborate design comprising a four-cylinder water-cooled engine and car type of transmission and drive.

The 67 cu. in. machine has attracted the attention of several important French makers. The most notable example is Citroen, who recently purchased the big Clement Bayard factory in which to produce his four-cylinder 52 cu. in. two-seater light car. This machine, although coming well within the piston displacement limit, is not officially recognized as a cycle car, for it exceeds the 770 lb. weight limit. Nevertheless it comes in direct commercial competition with the pure cycle cars. Peugeot also has a small two-seater with a piston displacement of only 41 cu. in. This is a four-cylinder water-cooled model with worm-driven rear axle. Mathis markets a 46 cu. in. cycle car the mechanical features of which are practically identical with those of his larger cars.

Another important firm interested in this class of machine is the Salmson Aviation Co. Soon after the war this company secured the manufacturing rights, in France, of the English air-cooled G.N. cycle car. This is still built, but the firm is just about to go into production on a 66 cu. in. four-cylinder, water-cooled, shaft-drive model which almost certainly will drive out the firm's air-cooled chain-driven car.

There are no standard dimensions for French cycle cars and light cars. Track varies from 40 to 43 in., and wheel-

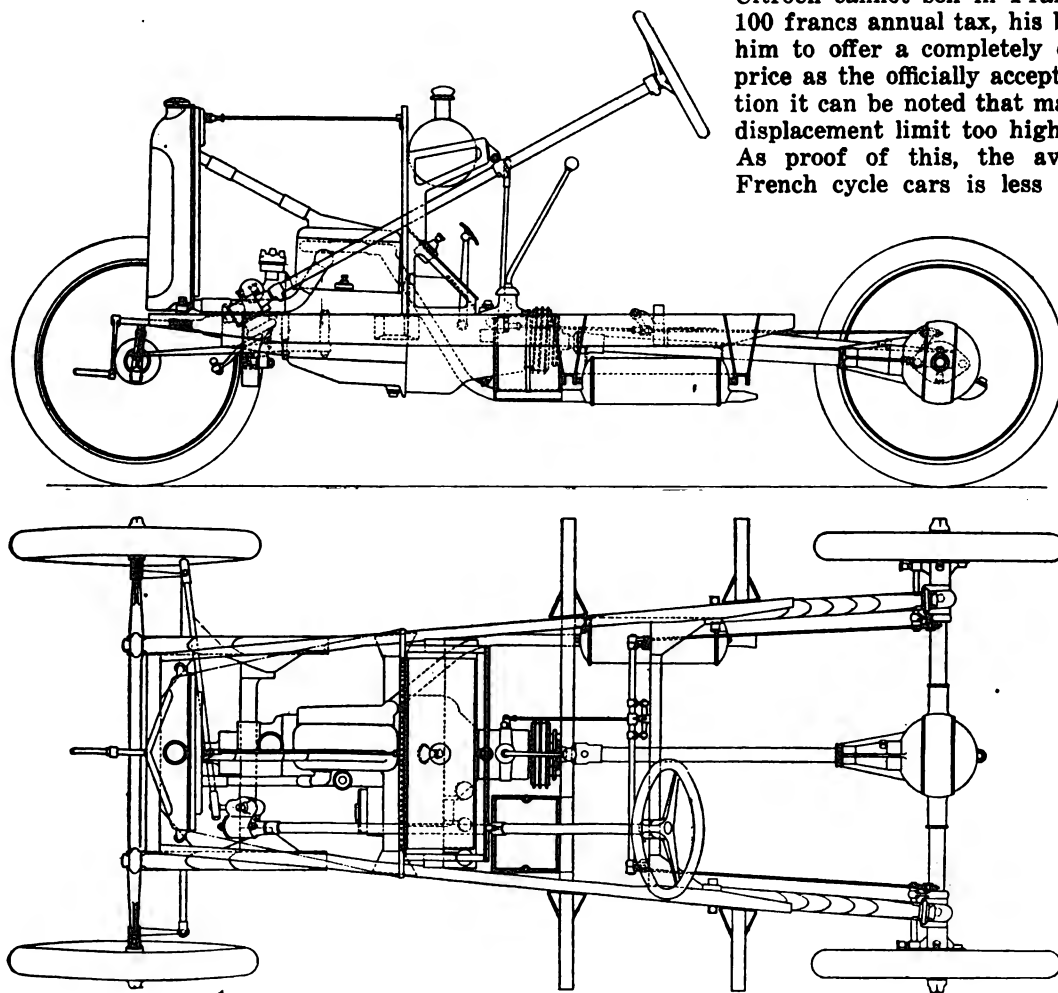
base is from 86 to 100 in. Wheels are nearly always wire, with 650 by 65 mm. tires (25 by 2½ in.). To get accommodation for two persons, the seats are nearly always staggered. To keep the selling price as low as possible, these machines are generally sold without electric lighting and starting. Some of them are designed to take a starter and lighting set as extras, while a minority have these as standard equipment. Owing to the weight limit of 770 lb. it is difficult to include electric lighting and starting with the machine. If this is added later, thus making the machine overweight, the manufacturer is not responsible if the tax collector takes action.

Citroen's 52 cu. in. light car has the same general features of design as his 10-hp. car. The four-cylinder engine measures 2.2 by 3.5 in. and has a detachable head, an aluminum crankcase and a 1.6 inch crankshaft with two bearings of 1.7 and 2.3 in. length. One of the features in which it differs from the bigger car is in the adoption of Delco lighting and starting. The Delco distributor is driven by helical gears off the camshaft and is carried just ahead of the forward cylinder. The generator is driven from the front end of the crankshaft. The car has a unit powerplant with three speeds and reverse, final drive being by Citroen herringbone gears. A differential is used, Citroen's experiments having shown that an axle without one is unsatisfactory. Rear suspension is by quarter ellipsics.

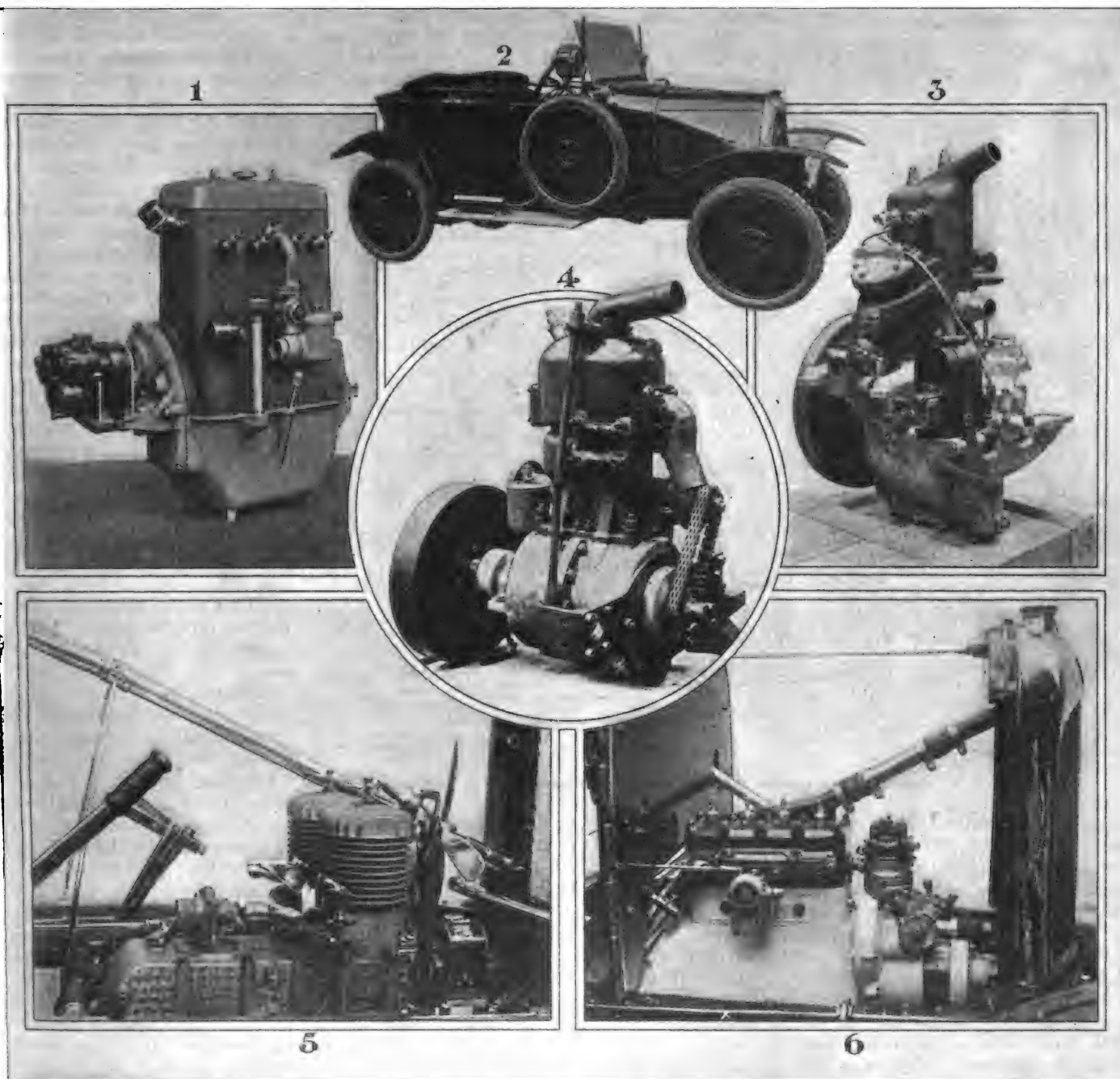
It would appear that Citroen's first idea was to get into the official cycle car class, but the decision, taken after long experiments, to make use of a differential, and to supply electric lighting and starting as standard equipment, brought the weight beyond the official figure. While Citroen cannot sell in France with the advantage of the 100 francs annual tax, his big means of production enable him to offer a completely equipped machine at the same price as the officially accepted cycle cars. In this connection it can be noted that many makers consider the piston displacement limit too high and the weight limit too low. As proof of this, the average piston displacement of French cycle cars is less than 60 cu. in., while all the

makers have difficulty in getting inside the weight limit.

Overhead valve engines are found plentifully in the modern French light cars and cycle cars. The new Salmson is a good example. The cylinders, 2.4 by 3.5 in., are of the detachable head type mounted on an aluminum base chamber, with valves inclined in the head. The front end of the crankshaft carries a helical gear which meshes with another pinion on a transverse shaft. The magneto is driven from one end of this shaft, while at the other end there is a second helical gear driving the camshaft. Four cams are used, each one serving for both the intake and the exhaust. The exhaust valve is opened in the normal way by the upward movement of an external push rod operating an overhead



Elevation and plan of Citroen 5-hp. chassis



1—M. A. S. E. overhead valve engine. 2—Francon two-seater with two-stroke engine and friction drive. 3—Francon two-cylinder two-stroke engine showing compressor. 4—Two stroke engine of Monroe friction drive cycle car. 5—Twin-cylinder two-stroke engine used on Bierlot cycle car. 6.—Citroen 5-hp. power plant

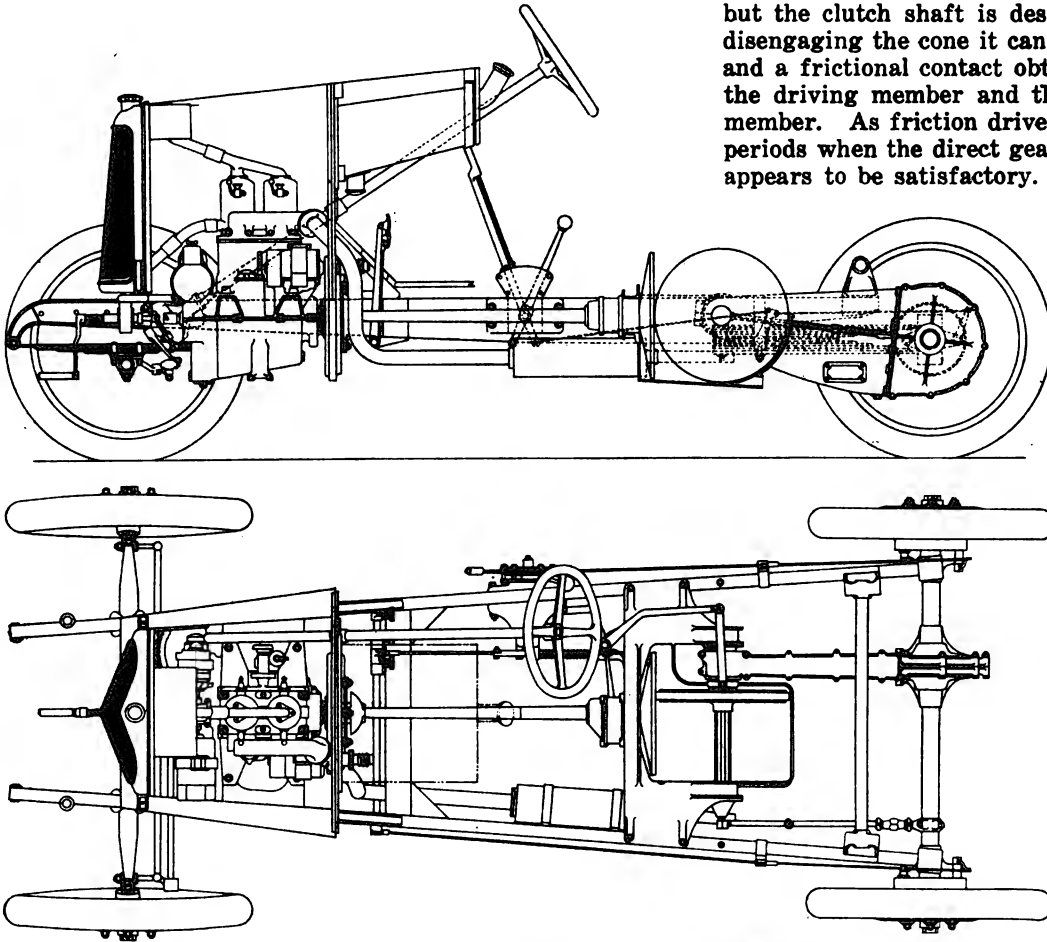
rocker arm. The intake valve is opened by the action of two coil springs having their extremities attached to the rocker arm and cylinder head respectively. Only the inertia of the valves has to be overcome for closing, and as the weight of each valve is only 1.7 ounces, the engine can run at a high number of revolutions. The plugs are mounted in the head of the combustion chamber, and the whole of this overhead mechanism is inclosed by an aluminum cover.

The transmission is a three-speed type, forming a unit with the engine, but with an open well for the flywheel and the cone clutch. Standard lines of construction are followed in the rear axle, with the exception that no differential is used. In addition to saving weight on the axle itself, this simplifies the brakes, which are of the internal expanding type on the wheel drums, one being operated by hand and the other by foot. In addition to being used on its own chassis, the Salmson powerplant has been adopted

by two other French manufacturers, Bignan and Sigma.

Engineer Cauzan, a French specialist in high-efficiency engines, is responsible for the powerplant of the M.A.S.E. cycle car. This is an overhead-valve engine with cylinders and upper half of crankcase in one casting. The push rods go through the cylinder casting and operate the vertical valves by means of rockers. The plugs are inclined just below the valves and the magneto is driven off the end of the camshaft. This 67 cu. in. engine weighs 127 lb. complete and develops 25 hp. maximum.

The M.A.S.E. chassis, built under Le Grain license, has a selective three-speed gearbox. Final drive is by inclosed propeller shaft with fabric universal joint at the front and bevel gearing rear axle without a differential. Cantilever springs are used at the rear. A couple of transverse springs, mounted one above the other, with a central bridge piece between them, fill the functions of the front axle, the steering pivots being carried between



Elevation and plan of Francon cycle car chassis

the outer extremities of the two springs. Steering is direct, with a spur gear reduction contained in a housing immediately under the wheel.

Engineer Picker, a motor specialist, is responsible for the powerplant of the Hinstin-Sup cycle car. This is another overhead-valve job, with external pushrods, detachable head and two-bearing hollow crankshaft with forced-feed lubrication. The three-speed transmission forms a unit with the engine, but with an open well for the flywheel and cone clutch. There are no special features in the chassis, which has a transverse front spring and quarter ellipsics at the rear. The rear axle is bevel-gear type without a differential. The horsepower obtained from this engine is stated to be 22, and as the weight of the chassis is 573 lb., there is sufficient margin for a comfortable two-seater body without exceeding the official limit of 770 lb. With this high power and low weight a very snappy car is obtained having a maximum speed well over 50 m.p.h.

Another successful machine is the Amilcar, built entirely on standard lines, with a 55 cu. in. water-cooled engine having valves on one side and a detachable head. The E.H.P. and Derby are other machines falling into the same standardized type.

In addition to the cycle cars built on what are generally accepted as standardized big car lines, there is an intermediate class of machine having the external appearance of a big car in miniature, but with a simplified type of transmission or drive. One example of this is the Carteret, with a normal type water-cooled L-head engine. The rear-axle housing is of aluminum alloy and contains straight bevel gearing without a differential. On top this car drives straight through from engine to rear axle by a cone clutch and propeller shaft. There is no gear box,

but the clutch shaft is designed so that after completely disengaging the cone it can be raised to any desired angle and a frictional contact obtained between the flat face of the driving member and the bevelled edge of the driven member. As friction drive is only employed for the short periods when the direct gear ratio is too high, this system appears to be satisfactory. The Fournier has a standard

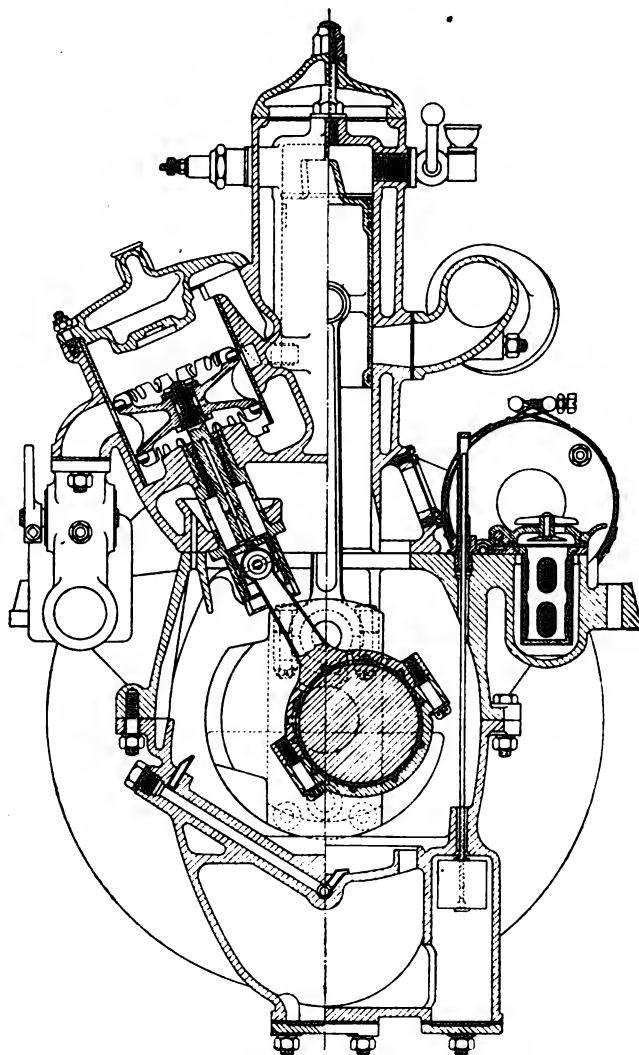
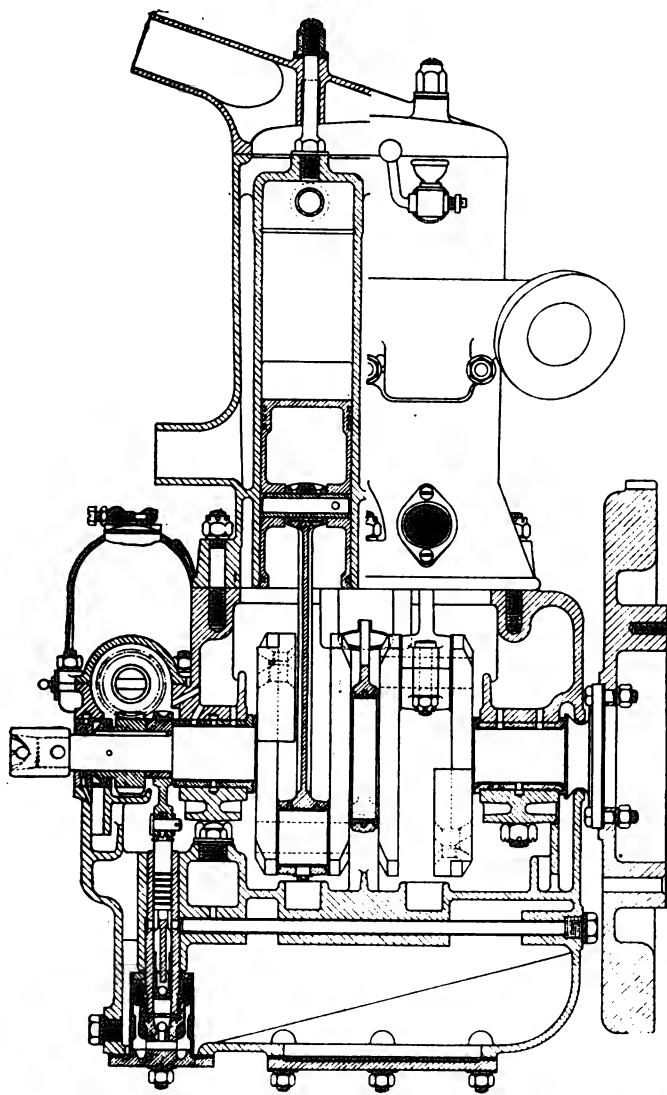
type of 55 cu. in. four-cylinder water-cooled engine, friction transmission and single-chain drive, without anything very distinctive in its makeup. There is a similar system of transmitting the power to the rear wheels in the Mourre cycle car. This, however, has a special two-stroke water-cooled engine, built under Violet patents, with two vertical cylinders having a common combustion chamber. The engine has been very successful in races, but has not sold very largely as yet.

The most original machine in this intermediate class is the Francon designed by Engineer Chedru, who for several years was attached to American automobile factories and later was with Panhard-Levassor. The Francon has one of the smallest

engines on the French market, the two cylinders, which operate on the two-stroke principle, measuring 2.1 by 3.9 in., giving a piston displacement of only 28 cu. in. On this engine Chedru has an interesting type of double-acting compressor and distributor driven by eccentric from the center of the crankshaft. This consists of an aluminum piston with one ring at the top and one at the bottom which compresses the charge and delivers it to the two working cylinders. The upper face of this piston acts for one cylinder and the lower face for the other cylinder. This construction calls for a cross-head and a gland, and advantage is taken of the piston-type crosshead to automatically lubricate the gland. According to official test carried out by the Automobile Club of France, the engine develops 10 hp. at 2000 revolutions, and its oil consumption varies from 10 to 13 oz. per horsepower-hour.

The friction transmission and single-chain drive adopted by Chedru have distinctive features. It has been sought to obtain complete protection and extreme rigidity, and with this object in view the driving and driven members are mounted within a rigid casting forming an aluminum well bolted to the two frame members. Provision is made for locking the driven disk in four positions on its shaft. The driving shaft has a fore-and-aft movement, under the influence of the clutch pedal, and is maintained in contact with the driven member by two coil springs, both of which are in operation for the reverse and two lower ratios, and one only for the two higher ratios. Final drive is by means of a chain contained within an aluminum housing which, in addition to completely protecting the chain, forms a radius member.

Frame members of the Francon are of ash. Semi-elliptic springs are used at the front and a double type of



Two sectional views of Francon two-stroke engine

quarter elliptic at the rear. The main spring consists of six leaves clipped below the frame members and immediately above this a second spring with three leaves having reversed camber. The two springs slide in blocks respectively above and below the axle housing. The lower spring and the main leaf of the upper spring carry all the load, the other leaves of the upper spring acting as a rebound check. The arrangement has proved satisfactory.

Cycle cars on motorcycle lines are not very common in France. In this class the three-wheel Morgan, of English origin, is one of the most popular. For the French market the machine with a twin-cylinder water-cooled engine is much more satisfactory than the corresponding machine with twin air-cooled engine.

Bleriot has a twin-cylinder two-stroke air-cooled engine, with the vertical cylinders set side by side on a com-

French Small Cars

MAKE	No. of Cylinders	Bore and Stroke	Piston Displacement	Valve Location	Cooling	Clutch	No. of Speeds	Transmission	Drive	Suspension	Differential	Wheel-base	Track	Wheels
Amilcar	4	2.1x3.7	55	L.	Water	Disk	3	Gear	Bevel	1/4 El.	No.	94	43	Wire... 700x80
Bedelia	2	3.1x3.9	61	L.	Air	None	3	Frict.	Belts	1/4 El.	No.	95	40	Wire... 650x65
Benjamin	4	2.1x3.2	46	L.	Water	Plate	3	Gears	Worm	1/4 El.	No.	90	34	Disk... 650x65
Bignot	4	2.4x3.5	66	L.	Water	Cone	3	Gears	Bevel	1/4 El.	No.	102	40	Wire... 650x65
Bleriot	2*	2.7x3.7	45	L.	Air	Disk	3	Gears	Belt	1/4 El.	No.	79	50	Wire... 710x85
Cartier	4	2.2x3.7	59	L.	Water	Cone	3	Frict.	Bevel	Cant.	No.	94	43	Wire... 650x65
Citroën	4	2.2x3.5	52	L.	Water	Plate	3	Gear	Bevel	1/4 El.	Yes	90	44	Disk... 650x65
Derby	4	2.2x3.3	55	L.	Water	Cone	3	Gear	Bevel	1/4 El.	No.	95	43	Wire... 700x80
E. H. P.	4	2.1x3.7	55	L.	Water	Plate	3	Gear	Bevel	Cant.	No.	90	43	Wire... 710x90
Fournier	4	2.1x3.7	55	L.	Water	Frict.	3	Frict.	Chain	1/4 El.	No.	90	43	Wire... 650x65
G. N.	2	2.1x3.9	28	L.	Water	Frict.	4	Frict.	Chain	1/4 El.	No.	90	43	Disk... 650x65
Grisson	2*	3.3x3.8	66	L.	Air	Plate	3	Bevel	Chains	1/4 El.	No.	95	40	Wire... 650x65
Hinastin-Sup.	4	3.3x3.4	60	L.	Air	Disk	2	Gears	Belt	1/2 El.	No.	86	40	Wire... 650x65
Mase	4	2.4x3.5	67	L.	Water	Cone	3	Gears	Bevel	1/4 El.	No.	96	43	Wire... 700x80
Mathis	4	1.9x3.1	46	L.	Water	Disk	3	Gears	Bevel	Cant.	No.	98	43	Wire... 650x65
Morgan	2	3.2x4	64	L.	Water	Plate	2	Gears	Chain	1/4 El.	No.	80	43	Disk... 700x80
Peugeot	4	1.9x3.3	41	L.	Water	Disk	3	Gears	Worm	1/4 El.	No.	90	36	Wire... 650x65
Salmon	4	2.4x3.5	66	L.	Water	Cone	3	Gears	Bevel	1/4 El.	No.	102	40	Wire... 650x65
Sánchez	4	2.1x3.7	55	L.	Water	Plate	3	Gears	Bevel	1/2 El.	No.	83	40	Wire... 650x65
Sigma	4	2.4x3.5	66	L.	Water	Cone	3	Gears	Bevel	1/2 El.	No.	102	40	Wire... 650x65

*—Two-stroke engine.

bined base chamber and gearbox. On this machine use is made of single rubber belt drive to the rear axle. Griffon makes a similar type of machine with twin V-type air-cooled engine, a motorcycle gearbox and single-belt drive. Bedelia, a pioneer in the cycle car field, has returned after several years' absence with a machine embodying an air-cooled engine, a system of friction drive from the main shaft of the engine to a lay shaft, and very long belts from the lay shaft to the rear wheels.

The G. N., a machine of ingenious design, has been the most successful of the pure cycle cars on the French market. This has a twin-cylinder air-cooled engine, a plate clutch and a counter shaft with dog clutches, by means of which single chain drive to the rear axle is ob-

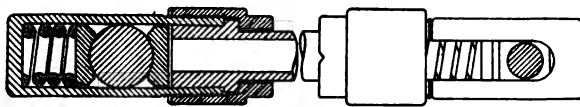
tained. Four chains are used, one being for reverse and the others for the three speeds forward. While this machine has been successful, it is significant that its French makers, the Salmson Co. have thought it necessary to bring out a four-cylinder water-cooled model of the same piston displacement designed throughout on car lines.

Reviewing the situation broadly, the cycle car, as it was known eight or nine years ago, has failed to make good in France. A type of machine which, while officially recognized as a cycle car, but in reality having little or nothing in common with motorcycle development, is proving its worth. These machines are generally diminutive automobiles with all frills removed and all the parts simplified to the lowest degree.

New Weldless Type of Drag Link

AN improved design of a "weldless" type of drag link for automobile steering, brought out by the Smith & Johnson Mfg. Co., is claimed to have a greater factor of safety than drag links now in use. Referring to the accompanying cut, it will be seen that the component parts are the same for both ends, and spring action in both directions is obtained by the positioning of the springs in the sleeve—one inside and the other outside the ball.

The springs are of standard design and furnished to customer's specifications as to weight, etc. The bearings



Detail of weldless type of drag link

are steel stampings made from a hemispherical blank and are pack-hardened to resist the wear of the ball. The lock washers are steel stampings and are heat treated so that the locking tongue will stand at least 8 bendings before breaking.

The sleeves are thimble-shaped steel stampings with the open and externally threaded and a slot in one side wide enough to permit free action of the ball arm. The nuts are steel stampings with one end hexed and the other end formed with 12 serrations to accommodate the tongue

of the lock washer and cut with an internal, tapered thread. The connecting tube is of seamless steel tubing, with its ends upset hot and then machined with a back taper. The finished nuts are placed on the tube before the last end is upset.

When this drag link is assembled on the car, the spring, bearings, ball, lock washer and end of tube are inserted in the sleeve from the open end. The nut is then screwed on the sleeve until the end of the sleeve and inner shoulder of the nut are tight against the ring boss of the tube end. As this nut is screwed on it forces the sleeve down against the back tapered end of the tube and rigidly holds the units together. The tongue of the lock washer is then forced into one of the serrations on the end of the nut and locks the nut to the sleeve.

Increased safety is claimed for this design of drag link because there are no welds and no large ball opening in the side of the sleeve. It is easy to assemble on a car because the angle of the ball opening is adjustable and the same drag link can be used for either right or left-hand drive. The link is also adaptable for use as a tie rod, as the short distance from the center of the ball to the end of the sleeve gives clearance for any type of wheel.

This drag link is furnished in four ball sizes of 1, 1½, 1¾ and 1½ in. diameter. Grease cup bosses may be specified either on the side or the end of the sleeve, and where adjustment for length between centers of balls is required a special nut is used on one end of the drag link.

New Denby Truck Model

THE Denby Motor Truck Co. recently started production on a new 2½ to 3-ton chassis mounted on 155-in. wheelbase. The new chassis incorporates the Continental C-2, four-cylinder, unit power plant, with 4⅞ by 5¼ in. cylinder dimensions. The chassis is designed to cover a wide range of purposes and is provided with plenty of room behind the seat. The length of the frame behind the driver's compartment is 144-in. The frame width is 33¼ in. and it is made of pressed steel, 6½-in. deep by 2½-in. wide. The frame is pressed from ¼-in. stock. Allowance for a body weight of 1500 lb. is provided in giving the 3-ton rating. The weight of the chassis is 4500 lb.

This truck is designed to have a speed range up to 25 miles per hr. on pneumatics and 18 miles per hr. on solid. The engine develops 39 hp. at normal speeds. Ignition is by magneto, cooling by centrifugal pump and lubrication by combined pump and splash system. The clutch is a Fuller, multiple disk, dry plate type lined with Raybestos. The gearset provides four forward speeds and one reverse and the rear axle is a Clark, model 2-D internal gear type pro-

viding an 8 to 1 reduction. The Hotchkiss drive system is utilized. The service brakes are on the propeller shaft, the brake drum being 8½-in. in diameter by 4-in. in width. The hand or emergency brake is an external contracting type on the rear axle. The front springs are 44 by 2¼ and the rear, 52 by 3½. The wheels are steel and the tires either pneumatic 36 by 6, front and 42 by 9 in. rear, or solid, 36 by 4-in., front and 36 by 7-in., rear. The regular equipment includes solid tires, oil lights, hand horn, bumper, towing hooks and tools and sells for \$2795 f. o. b. Detroit.

ON Jan. 1, 1921, the public transport services in Paris and suburbs was taken over by the Department of the Seine, which transferred them to a new company. During the first ten months of working under the new management the motor omnibuses conveyed 200,000,000 passengers against 135,000,000 in the corresponding period of the previous year. The receipts increased from 40,000,000 francs to 67,000,000 francs.

Design and Functioning of Laminated Automobile Suspension Springs

Part II

The writer deals with the different spring steels and the various component parts. In concluding he gives specifications for a standard testing procedure for testing raw spring material and the finished product.

By A. A. Remington*

TO insure maximum economy of material in a spring, it is necessary that the maximum stress of which the material is capable shall be carried by every section, or, in other words, that no one section shall be stressed more severely than any other section, so that the mean fiber stress shall be the maximum fiber stress. We have seen that this is attained by the basic rhombus, and therefore theoretically by a laminated spring strictly obeying what may be termed the "rhombus law."

Springs so designed are, however, not generally used in automobile work, but in adopting modifications it is desirable that they shall affect the stress distribution as little as possible, as every divergence between maximum and mean fiber stress involves using more spring steel for a given performance, resulting in greater weight and cost, a lowered efficiency and less reliability for the same mean fiber stress.

Any deviation in a spring from strict conformity to the "rhombus law" increases the stress at certain points and decreases it at others, and while the load-carrying capacity of the spring as represented by a certain amount of deflection under a certain load may not be affected, the modification in stress distribution may so increase the stress at certain points as to seriously reduce the safe maximum load that can be sustained by the spring.

Grading

In order to produce springs which will possess the ability to rebound past their "no-load" position without separation of the leaves, it is usual to provide "nip" by giving an increased camber to each successive blade. If the blades are all of the same thickness, this results in an increased stress in each successive blade, as when the spring is "nipped" up, the stress in some blades is negative, the negative and positive stresses balancing each other to produce equilibrium, as shown in Fig. 15 already referred to. When, therefore, such a spring is loaded externally, the load produces stress, which must be added to the initial stress, thereby producing a greater stress in the more highly cambered blades.

This cause of irregularity in the stress distribution can be minimized but not eliminated by grading the thickness of the blades. The stress in a blade varies with the thickness, so that increased camber and with it "nip" can be embodied with successively thinner blades without increase of stress, and this is frequently done in the lighter classes of automobile springs in which rebound past "no-load" position is assumed to be more likely to occur.

Owing to the variation in blade thickness adopted, the grading is seldom proportionate to the amount of "nip," so that the thicker blades are usually unduly stressed, and in the author's opinion it is preferable to keep all the blades of uniform thickness and the "nip" to the minimum practical amount, and have in consequence a somewhat higher stress in the shorter blades and a lower stress in the longer blades than the mean calculated figure.

The way in which "nip" tends to interact with grading in maintaining greater uniformity of stress is illustrated in Fig. 16, where the stress/strain curves for two hypothetical cases are superimposed, showing that whatever proportions are adopted, while the stresses in blades of varying thickness may be made more nearly uniform by providing a certain amount of "nip," they will only be identical at one deflection, i. e., where the lines cross in the diagram, which is shown for a two-blade spring with one blade twice as stiff as the other.

Stiffness

The stiffness of a spring is its resistance to deflection, and primarily depends on the modulus of elasticity of the material. The basic formula for deflection in convenient

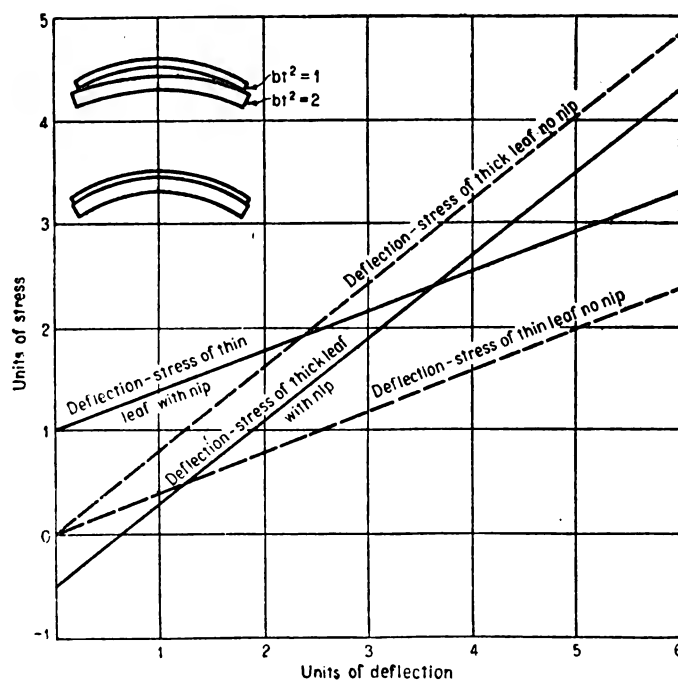


FIG. 16.—Chart showing effect of "nip" in tending to equalise stress in blades of different thicknesses.

*Paper presented to the Institution of Automobile Engineers. Slightly condensed.

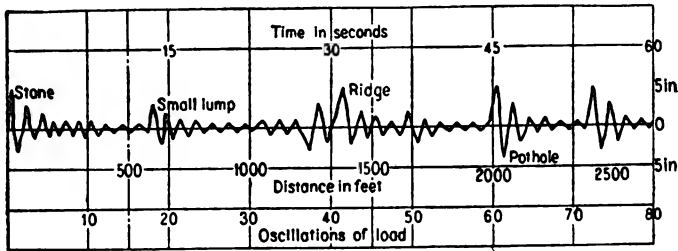


FIG. 17.—Imaginary graph of the movements of a spring of a vehicle travelling at 30 m.p.h. on an ordinary road.
Period = 80 per min. = 1 complete swing
per 0.75 sec. or per 33 ft.

form for laminated spring calculation has already been given, namely:

$$d = (WL^3)/(4bEnt^3).$$

It is found in practice that this formula requires adjustment, and it is convenient to make the adjustment in the value of E , which, instead of 27.5×10^6 , the mean value for the steel, is found to vary for actual springs according to details of construction from about 18×10^6 to about 25×10^6 , the low value being due principally to the difference between the nominal and the actual dimensions of the section and to variations in blade lengths and thickness. Quite small variations in blade thickness affect the deflection considerably, as deflection varies as t^3 . In calculating deflection in the absence of exact information, it is advisable to adopt a mean figure, say, 22.5×10^6 , in conjunction with the nominal blade thickness, and a table of the values of nt^3 for the usual blade thicknesses adopted is given in Appendix I.

This table is equally useful for a graded spring, as the value nt^3 is the sum of the nt^3 values for the separate blades of which the spring is composed, for example:

2— $\frac{1}{2}$ in. blades	... $2t^3 = 0.250$
3— $\frac{7}{16}$ in. blades	... $3t^3 = 0.252$
4— $\frac{3}{8}$ in. blades	... $4t^3 = 0.212$
	<hr/>
	$nt^3 = 0.714$

Material

Many different compositions of steel have been used for automobile suspension springs. In use, the material must be capable of considerable bending in a part having reasonably uniform stress distribution, and if over-stressed it should preferably take a permanent set and not break. It must withstand an almost unlimited number of stress cycles between a low and a high stress, with occasional reversals, the stress being deducible from the diagram in Fig. 17, which has been plotted to illustrate spring action from the author's imagination guided by tests made with an apparatus which measured maximum deflection in service.

The material must also have a high resistance to cracking, and as it is essential to use material with a high yield point and therefore comparatively little ductility to obtain sufficient elastic bending, cracks are liable to cause trouble; the material should, therefore, preferably be of such a nature that if a crack occurs or exists in a blade its liability to extend is as small as possible. This is best obtained with a laminated plate, and such laminations can be obtained by using a rolled steel containing "slag" inclusions, providing they are suitably rolled out along the plate. In such a steel a crack is to some extent intercepted by the "slag" lines which cause a certain amount of discontinuity, and is therefore less liable to extend.

The steels most largely used in the manufacture of laminated springs may be divided into three groups by compositions:

1. Carbon steels, basic and open hearth, the carbon content ranging between approximately 0.50 and 1.0 per cent.
2. Carbon chromium steels, with or without the addition of a small percentage of silicon or vanadium, the carbon content ranging between approximately 0.45 and 0.6 and the chromium content between 0.50 and 1.50.
3. Silico-manganese steels, having a carbon content ranging between 0.50 and 0.80.

The steels are used in the hardened and tempered condition, being usually hardened in oil and tempered in a lead bath.

The chemical compositions and physical properties of various spring steels are given in Tables III and IV, and a tempering curve for one characteristic steel, showing the effect on the resulting physical properties of tempering at different temperatures, is given in Fig. 18.

The modulus of elasticity of the steel itself is substantially the same for all steels, and a suitable mean value is, as has already been mentioned, 27,500,000 in lb.-in. units. Variations due to inaccuracies in the determination of this value are probably greater than variations due to differences in composition of the steel.

American Spring Steels

The American Society for Testing Materials publishes three specifications for spring steel bars, but only specifies method of manufacture and composition.

These three specifications cover:

- Carbon steel in two grades.
- Silico-manganese steel in two grades.
- Chromium vanadium steel in two grades.

The standard compositions are shown in Table V.

This Society has not published any data in regard to the physical properties of spring steel, but publishes in addition a specification for laminated elliptic springs for automobiles which includes an elaborate testing procedure. This specification provides for a maximum test load of twice the normal load, and specifies that the flexibility shall be measured by determining the height under 75 per cent and 125 per cent normal load and dividing the difference in loads by the difference in heights. This and other provisions in the specification make the testing an unnecessarily complicated procedure.

The provision of an arbitrary test load of twice the normal static load is unnecessarily severe in certain cases, and if insisted on would necessitate the use of a lower working stress than would otherwise be permissible, resulting in such cases in unnecessarily heavy springs.

Test of Material

The usual tensile, Brinell and Izod tests on the standard specimen, as adopted for structural steels, are, with the exception of the Brinell test, not directly useful for spring blades. The Brinell test, although it does not indicate directly any particular property, is a convenient means of checking the accuracy of the heat-treatment and is therefore to be recommended, and spring blades tempered to a suitable Brinell range for the steel employed are more likely to give satisfactory service than those either above or below. If below, the permanent-set point will be reached before sufficient bending has taken place, and if above, the plate is more liable to develop cracks from quenching strains or to have insufficient ductility.

The Brinell range for all steels is much the same, and the useful range for existing steels may be considered to lie between Brinell hardness Nos. 363 and 461. It is well known that the Brinell hardness number gives a very close approximation to the tensile strength when multiplied by

a suitable factor, but that the factor varies with the hardness and condition of the steel. For hardened and tempered spring steels the factor is found to be 0.22, and Table VI has been calculated on that basis.

Unfortunately, no standards at present exist on which to form a basis of comparison or to enable specifications to be prepared for tests that are suitable for spring steels, so that it is usual to depend on the composition, a standard heat-treatment and a hardness check, the remainder of the testing being carried out on the manufactured spring itself. Under these conditions, it is obviously necessary to control the temperatures comparatively closely, and, unfortunately, owing to the methods usually adopted in fitting springs, there is liable to be considerable variation in the maximum temperature reached and in the actual quenching temperature. This results in undesirable variations in micro-structure, which may affect the endurance of the blade and may not be capable of being detected by the Brinell test or in fact by any of the usual physical tests, and may even increase the apparent ductility as measured by elongation percentage in the tensile test.

Tests of Springs

At a first test it is usual to "scrag" a laminated spring cold by loading it rapidly to a test-load greater than its designed static load a number of times in succession. It is then measured for load at standard deflection, which checks its conformity to the drawing and also its rate of deflection. It is then "overloaded" and again tested for load-deflection as a safeguard against permanent set.

These tests have no particular meaning, except that they prove the particular spring as far as load-carrying capacity and freedom from permanent set are concerned, but if some uniformity were exhibited in the ratio between theoretical stress and maximum deflection under the "scrag" they could be made to indicate the quality of the material. If springs are made to identical design in carbon and alloy steels respectively, it is possible to find a load that will produce a permanent set in the carbon steel spring, but which the alloy steel spring will withstand without injury.

Springs can be made to carry out the desired load-deflection to a considerable degree of accuracy, and it is reasonable to expect that a series of springs will be alike within a variation from the specified load of plus or minus 5 per cent at a specified camber.

Blade Ends

It is usual in this country to taper the blade ends in thickness, presumably to obtain the rhomboid characteristics by reducing the blade thickness instead of the blade width. To do this accurately would involve making the open end of each blade as a parabola, a form difficult of accomplishment, and in practice the thinning is usually overdone and necessitates a sudden change of camber if "opening at the ends" is to be avoided. It would seem to be better practice to use full-thickness blades and adopt a "spear" of suitable form for this construction.

Eyes

It is usual, in fact almost universal, practice to use rolled eyes in automobile springs. In the best practice it is not unusual for the blade to be slightly thickened and widened at the eye and for a short distance down the blade as shown in Fig. 19. The thickening reduces the tendency of the end of the main blade to "give," thus reducing the necessity of "full-length" blades to support it, a practice which is liable to result in a disproportionate spring and the consequent use of an unnecessary amount of steel.

After rolling, the eyes should be bored through, and in the best practice a gun-metal bush is pressed in and

reamed to size, and the ends of the bush and eye faced down to the normal breadth of the spring, within narrow limits. This enables the shackle and shackle-pin to be made to fine limits, and insures a good tight fit at a point where only too many cars early develop squeaking and rattle.

Center-Bolt

Many schemes have been proposed, and some are in use, to do away with the center-bolt and the consequent weakness which it is supposed to introduce. The center-bolt requires to be made of high-class steel as it must be kept reasonably small, and is depended on in "shear" to keep the blades in position longitudinally as well as in tension to hold against the "nip" until such time as the spring is clipped to the axle or other retaining member.

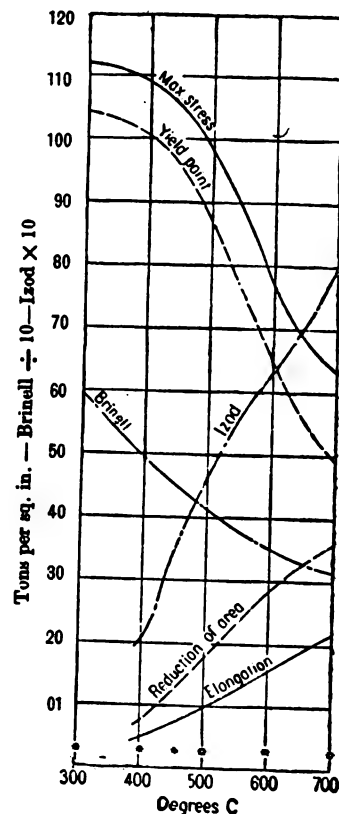
The relations between spring width and center-bolt diameter have been standardized in America.

Clips

It is usual to fit a "slip" near each end of a spring to hold the longer blades in position laterally and also to assist in preventing them from separating on rebound. These "slips" are commonly used in two forms, one involving a rolled eye, and the other rivets through the blade, as shown respectively at A and B in Fig. 20.

Spears

The more usual forms of "spear" are shown in Fig. 21. The semi-circular, segmental and gothic spears are usually used in conjunction with tapered blades, and the pointed spear with full-thickness blades; in fact, the latter is not



Silicon-Manganese Steel.

Carbon 0.76.

Silicon 2.17.

Manganese 0.56.

Sulphur 0.035.

Phosphorus 0.038.

Test bars 1½ dia.

Test pieces 0.564 in. X 2 in.

Oil hardened 830°. Water quenched from temperatures indicated.

FIG. 18.—Tempering chart.

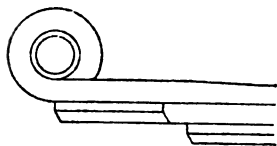


FIG. 19.—Spring end showing thickened eye.

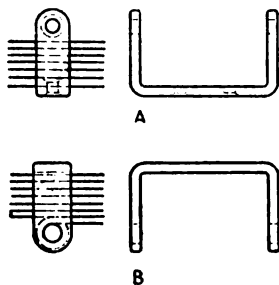


FIG. 20.—Usual forms of spring clip.

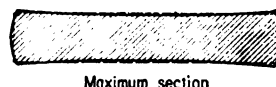


FIG. 22.—Sections of spring blades.

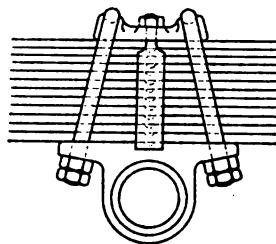


FIG. 23.—Suggested method of mounting a heavy spring.

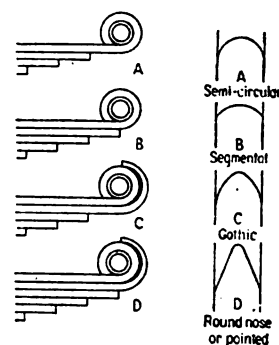


FIG. 21.—Blade ends and spears.

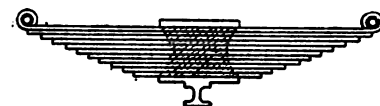


FIG. 24.—Loss due to wide bed.

suitable for tapered blades, and it will be observed that it will conform to the rhombus law if made of suitable proportions, without any thinning of the blade:

Effect of Essential Factors

In considering the best proportions for a spring, the effect of the various factors must be taken into consideration, and the principal of these are:

1. Full-length top blade.
2. "Nip."
3. Grading.

These three factors, as has been shown, affect the stress distribution, and the object of the spring designer should be to balance the antagonistic characteristics so as to maintain the maximum possible uniformity of stress throughout the spring.

The adoption of any proportion that alters the stress distribution necessitates more material in proportion to the ratio between the maximum stress at any point and the mean stress, and so results in a lowering of the safe static mean stress.

Proportions

From current practice it would appear that laminated automobile suspension springs should have not less than five blades and not more than sixteen, and that the width should be between $1\frac{1}{2}$ in. and $4\frac{1}{2}$ in., and be such that the total thickness of the spring should be not less than half nor more than twice the width.

The amount of flexibility and the permissible stress has already been considered, and it is clear that an infinity of springs can be designed to comply with any given specification.

There is little indication that a multiplicity of blades makes better riding, and therefore it is probably best to adopt a length and breadth that will provide a spring with a moderate number of blades and a thickness not much exceeding its breadth as producing the most satisfactory spring.

Deflection Under Load

To ascertain accurately the deflection under load of blades of different lengths and thicknesses, separately and in combination, the author has prepared a series of straight blades of different lengths so as to make up proportionate two-blade, three-blade and four-blade springs, and loaded all the blades, first separately so as to get a load-deflection curve for each blade, and then in combination, so as to obtain the loads and reactions at the blade

tips. In this manner it is quite simple to plot a bending-moment diagram for each blade under any load, and to ascertain the degree of compliance with the "rhombus" law and the actual variation in stress in the different blades which results from alterations in relative blade lengths, etc.

A research somewhat on these lines was carried out in America by David Landau,* who found non-compliance with the "rhombus" law and irregularity of stress in non-speared springs with blades of uniform thickness, as might have been expected. The author confirmed Landau's results and established experimentally that springs can be made with uniform stress. At some future date he hopes to extend the research to investigation of the effect of "nip" in combination with grading on the stress distribution, so as to verify on actual spring blades the accuracy of existing theory.

It is probable that general practice in regard to "nip" and "grading" is susceptible of great improvement in the direction of increased uniformity of stress and resulting economy of material by permitting higher mean stresses without any reduction in endurance.

Maximum Test Load

Automobile springs should be designed so that a test load in excess of the normal static load by a definite amount may be applied without overstressing. This test load will vary between 1.75 and three times the normal load for reasons already considered, and should be applied to every spring as a standard test.

Standard Test

A suitable specification for a standard testing procedure, including the foregoing provision, is as follows:

1. *Material*.—The temper of the spring blades shall be verified by the Brinell test.

2. *Scragging*.—All springs shall be "scragged" before load-testing by means of a power "scrag," which shall deflect the spring rapidly not less than four times to an extent not less than its calculated deflection under the test load.

3. *Testing*.—Springs for test shall be mounted for load-test so as to permit free horizontal movement while remaining in the position selected for test.

Cantilever springs, when tested one end at a time, and quarter-elliptic springs shall be clamped to a pressure-block in the form of a stiff beam of sufficient length to maintain the spring in position.

All measurements for height shall be made between the surface of the pressure-block and a line joining the centers

*See Journal of the Franklin Institute, April, 1918.

of the eyes, or, in a quarter-elliptic spring, between the centers of the eye and the pressure-block measured at right angles to the surface of the block.

The clamping of springs for test shall provide sufficient rigidity for accurate measurement of deflection.

When measuring the deflection of a spring, the load shall be applied gradually and in such a way that the required load shall not be exceeded.

4. *Test Load.*—The specified test load shall be applied to all springs.

5. *Loaded Height.*—The loaded height shall be the height measured when the normal load is applied after scragging.

6. *Permanent Set.*—After the "scrag" test has been applied, and the loaded height has been measured, the maximum test load shall be applied and fully released, and the loaded height again measured, the difference being the permanent set.

7. *Rate of Deflection.*—The rate of deflection shall be determined by measuring the height under normal load and dividing the normal load by the distance deflected from the free position.

8. *Free Height.*—The free height is governed by the rate of deflection.

Accuracy of Dimensions

The bars from which the blades are made are rolled concave on the faces, as shown in Fig. 22, so as to insure a close fit at the edges and to leave space for lubricant. The exact amount of concavity is not important, and to avoid a multiplicity of rolls of different radii it is usual to permit considerable tolerance. The usual practice results in the blade being about 0.012 in. to 0.018 in. thinner in the middle than at the edge, and the total tolerance on thickness permitted is usually about 0.008 in.

Although there is at present no standard, it is best practice to provide the thickness tolerance all on the plus side, to assist in compensating for the loss of section due to concave rolling as shown in Fig. 22, where the nominal size is shown in dotted lines.

To ascertain the accuracy to which springs are actually made, the author has analyzed and measured many springs in detail, and a selection of these measurements is given in Appendix II.

Fixing

The fixing of a spring on an axle is an important matter. In the case of heavy springs with many blades, a wide bed renders a considerable portion of the center of the spring inoperative, and therefore wastes a considerable amount of spring steel. It is, however, necessary to have a fairly wide bed, especially when there is a center bolt, as the bending moment must not be permitted to come on the blades at the center where they are weakened by the hole.

A method of fixing which provides a wide bed and yet renders most of the center portion of the spring operative is shown in Fig. 23. The clips, it will be observed, are placed on an angle and are made of a form which avoids weakening them by bending them over sharp corners. A scheme that is in general use for avoidance of the center bolt is also shown, and the author believes this to be the best way of fixing heavy springs.

Where a wide bed and equally wide top plate are used, the spring becomes, in effect, two half-cantilever springs of a length somewhat greater than the unclipped length, as shown in Fig. 24, and the advantage in the direction of weight-saving by utilizing more of the spring as is the case with fixings of the type shown in Fig. 23 is obvious. In the case of small springs which are comparatively thin and which can consequently be used with comparatively narrow beds, the same difficulties do not arise, and the

loss of effective spring steel is, of course, proportionately less.

In connection with spring fixings, it is advisable to avoid a sharp edge across which the spring has to bend, in fact, a considerable radius is preferable. The use of soft packing, either above or below the spring, is to be deprecated, and the rounding of the bed and clip plate is a preferable expedient and minimizes any tendency for the clips to work loose. It is, of course, imperative that the clips shall always be tight, as in most designs it is the friction between the spring and the axle that is depended upon to keep the two parts in their correct relative positions. Although the center bolt head may be recessed, this can only be considered a location, and should not be depended on to take load.

Appendix I

FORMULÆ AND TABLES FOR CALCULATING SEMI-ELLIPTIC SPRINGS

$$d = \frac{WL^3}{4bEnt^3}$$

$$f = 1.5 \frac{WL}{bnt^2}$$

$$f = \frac{6Etd}{L^3}$$

$$W = \frac{4bEdnt^3}{L^3}$$

$$E = \frac{WL^3}{4bEnt^3}$$

$$T = \pi \sqrt{\frac{d}{12g}}$$

$$= \pi \sqrt{\frac{WL^3}{4bEnt^3}} \quad 12g$$

$$P = \sqrt{\frac{35,230}{d}}$$

$$nt^3 = \frac{1.5 WL}{bf}$$

$$nt^3 = \frac{WL^3}{4bEd}$$

W = load in lb.

L = length in in.

E = modulus of elasticity (modified value) in lb. per sq. in.

P = rate of oscillation (number of complete oscillations per minute).

T = time of one complete oscillation in seconds.

f = stress in lb. per sq. in. (as given by the beam formula).

b = breadth of blade in in.

n = number of blades.

t = thickness of blade in in.

d = deflection in in.

g = acceleration due to gravity in ft. per sec. per sec. (32.2).

Appendix II

INVESTIGATION OF ONE REPRESENTATIVE FRONT AND ONE REPRESENTATIVE REAR SEMI-ELLIPTIC SPRING TAKEN AT RANDOM FROM A BATCH DELIVERED BY THE MAKERS

Characteristics

	Front	Rear
Loaded length.....	37 in.	52 in.
Width	2 in.	2 in.
Leaf number.....	8	9
Leaf thickness.....	1½ in.	2½ in.
Leaf thickness.....	1½ in.	3½ in.
Leaf thickness.....	2½ in.	4½ in.
Leaf thickness.....	4½ in.	.....
Total thickness....	2½ in.	2½ in.
Static load.....	900 lb.	1200 lb.
Loaded height....	2½ in.	2½ in.
Free height.....	4½ in.	7½ in.

Chemical Composition and Mechanical Properties of Main Leaves

	Front	Rear
Carbon	0.60	0.64
Silicon	0.32	0.25
Manganese	0.54	0.54
Sulphur	0.019	0.025
Phosphorus	0.022	0.023
Chromium	0.51	0.56
Maximum stress, tons per sq. in.	85	86
Yield point, tons per sq. in.	80	83
Elongation, per cent.	8.5	8.0
Reduction of area, per cent.	27	24
Brinell number.	372-388	388-415
Izod ft.-lb.	14-16	12-14

Brinell Hardness Number of Leaves (tested at the centre of length)

Blade	Front	Rear
1.....	372	388
2.....	363	388
3.....	388	388
4.....	388	388
5.....	363	388
6.....	363	363
7.....	415	352
8.....	388	363
9.....	—	388

Deflection Test on Portions Cut from Leaves

Front				Rear			
Load, lb.	$12 \times 2 \times 0.295$	$12 \times 2 \times 0.270$		$12 \times 1.995 \times 0.298$	$12 \times 1.985 \times 0.260$		
D	P	f	D	P	f	D	P
100..	0	0	0	0	0	0	0
100..	25	0	10,300	44	0	12,300	0
500..	130	0	51,700	186	0	61,700	0
1,000..	273	0	103,500	374	0	124,000	0
1,200..	336	0	124,200	449	2	150,000	0
1,400..	393	0	145,000	526	7	173,000	0
1,600..	452	2	166,000	605	14	198,000	0
1,800..	512	3	186,000	685	30	223,000	0
2,000..	575	7	207,000	0	0	0	0

D = deflection in thousandths of an inch. P = permanent set in thousandths of an inch. f = calculated stress in lb. per sq. in.

Deflection Test on the Complete Spring

Front				Rear			
Deflection in in.	Load in lb.	Loaded Length in in.	Permanent Set in in.	Load in lb.	Loaded Length in in.	Permanent Set in in.	
1	714	37.0	0	330	51.5	0	
2	1,444	37.2	0	510	52.5	0	
3	2,098	37.3	0	785	53.1	0	
4	2,840	37.0	0	1,013	53.5	0	
5	3,578	36.8	0	1,195	54.0	0	
6	4,372	36.3	0	1,405	54.2	0	
7*	5,124	35.8	0.25	1,610	54.3	0	
8	....	....	....	1,808	54.4	0	
9	....	....	....	2,014	54.4	0	
10	....	....	....	2,214	54.2	0	
11†	....	....	....	2,590	54.1	0.25	

*Equivalent to $3\frac{1}{4}$ in. reverse camber on front spring.
†Equivalent to $3\frac{1}{4}$ in. reverse camber on rear spring.

Periodicity Test on Complete Springs

Complete Oscillations Per Minute		
Load, lb.	Front Spring	Rear Spring
200	160†	140
400	160	116
600	136	92
800	112	76
1,000	92	68
1,200	..	64

†Doubtful as regards accuracy. Result is probably too low as a regular swing is difficult to maintain.

Modulus of Elasticity of Steel Calculated from Deflection Tests

Leaf Dimensions, in.	Modulus, lb. per sq. in.
$12 \times 2.000 \times 0.295$	28,750,000
$12 \times 2.000 \times 0.270$	29,250,000
$12 \times 1.995 \times 0.298$	30,850,000
$12 \times 1.985 \times 0.260$	30,000,000

Appendix III

AN ANALYSIS OF DIMENSIONS OF A NUMBER OF ACTUAL SEMI-ELLIPTIC SPRINGS TAKEN AT RANDOM FROM CURRENT PRACTICE SHOWING THE MEAN STRESSES ADOPTED

	Loaded Static Load, lb.	Length in.	Width, in.	Number and Thickness of Leaves, in.	Mean Static Stress Per lb. sq. in.
Rear 5-ton truck..	7,280	54	3.5	$\left\{ \begin{array}{l} 13 \frac{1}{2} \\ 6 \frac{1}{2} \\ 6 \frac{1}{2} \end{array} \right\}$	75,000
Front 4-ton truck.	2,000	42	2.5	$\left\{ \begin{array}{l} 8 \frac{1}{2} \\ 4 \frac{1}{2} \\ 3 \frac{1}{2} \end{array} \right\}$	51,400
Rear 3-ton truck..	4,700	54	3.5	$\left\{ \begin{array}{l} 11 \frac{1}{2} \\ 4 \frac{1}{2} \\ 5 \frac{1}{2} \end{array} \right\}$	62,000
Rear 4-ton truck.	5,600	54	3.5	$\left\{ \begin{array}{l} 9 \frac{1}{2} \\ 1 \frac{1}{2} \\ 4 \frac{1}{2} \end{array} \right\}$	75,000
Front 40-hp. car..	900	37	2.0	$\left\{ \begin{array}{l} 8 \frac{1}{2} \\ 1 \frac{1}{2} \\ 2 \frac{1}{2} \\ 4 \frac{1}{2} \end{array} \right\}$	39,000
Rear 40-hp. car...	1,200	52	2.0	$\left\{ \begin{array}{l} 9 \frac{1}{2} \\ 2 \frac{1}{2} \\ 3 \frac{1}{2} \\ 4 \frac{1}{2} \end{array} \right\}$	71,000
Front 12-hp. car..	400	34	1.5	$\left\{ \begin{array}{l} 5 \frac{1}{2} \\ 1 \frac{1}{2} \end{array} \right\}$	56,000
Rear 12-hp. car...	600	42	1.5	$\left\{ \begin{array}{l} 6 \frac{1}{2} \\ 1 \frac{1}{2} \end{array} \right\}$	87,000

The stress shown in the last column is the average static stress due to the static load, assuming equal stress-distribution throughout the spring based on the formula—

$$f = (1.5 WL) / (bnt^2),$$

which includes the value—

$$bt^2/6,$$

and is therefore the stress value obtained by the ordinary beam formula which, as has been shown, may be considerably greater than the actual fiber-stress sustained by the material.

The maximum stress sustained by the spring is that due to the test load, and in normal practice this should be obtained by multiplying the normal static stress by a factor which should vary from 1.75 to 2.25 for rear springs, and from 2.5 to 3.5 for front springs.

A Comprehensive Highway Transport Outline

A COMPREHENSIVE outline of highway transport has been prepared for the Highway and Highway Transport Education Committee.

Although making no pretense of being complete, the outline treats exhaustively of the various phases which make highway transport one of the dominant subjects of the day. It was prepared by Professor Lewis W. McIntyre, Assistant Professor of Civil Engineering, University of Pittsburgh, at the urgent insistence of schools of engineering and economics, highway engineers and highway officials, and is expected to be the forerunner of text books on the subject, to which many of the leading economists and engineers in the country are giving their attention.

This outline may be adapted for classroom exercises and lectures, or it may be used by engineers and business men actively engaged in the manufacture of motor vehicles or the construction of highways.

Subdivided into five divisions, it treats of the field of highway transport, the highway and the motor vehicle, legal phases of the subject, principles of successful operation and the selling of transportation.

The booklet is being distributed by the Highway and Highway Transport Education Committee, from its offices in the Willard Building, Washington, D. C., first to colleges and universities and then upon request to manufacturers and business men.

Function and Operation of the Vibrating Voltage Regulator

The development and characteristics of this type. The writer states that the early causes of failure were either mechanical or due to variations in output and explains the methods used to overcome these difficulties.

By W. P. Loudon*

THE purpose of the vibrating regulator in an automobile lighting system is to maintain the voltage at a nearly constant value regardless of the load or battery conditions. The result of this type of regulation is that charging current is furnished to the battery in inverse proportion to its state of charge, that is, a high current to a discharged battery and a low or practically zero current to one nearly full.

The main object of such a system is, of course, to bring an exhausted battery to its fully charged state in the shortest time, without introducing injurious effects which would shorten the service life of the battery. It is essential that the battery be always nearly fully charged in order to obtain the maximum efficiency from the starting apparatus, the lights, and, in cold weather, to eliminate danger of freezing.

The "Tapering" Charge

Theoretically, in a constant potential system, the battery is charged most efficiently by starting with an initial current flow in amperes equal to the ampere hour rating (5 ampere discharge rate) of the cells—and gradually decreasing this amount in proportion to the state of charge, so that when charging is completed, the current will have dropped to zero. Obviously, this would necessitate units capable of generating and carrying relatively large outputs, and which for the greater part of the time would be operated at far below their normal capacity. Such a course would naturally be not only expensive, but would add considerable excess weight to the car, and would be unjustified, even though sufficient space were available for the installation of the larger units.

As in nearly all engineering problems, it is necessary to effect a compromise. The initial rate is, then, so chosen as to permit the use of normal sized units and at the same time insure the charging of an exhausted battery in from eight to ten hours.

Two Functions of Regulator

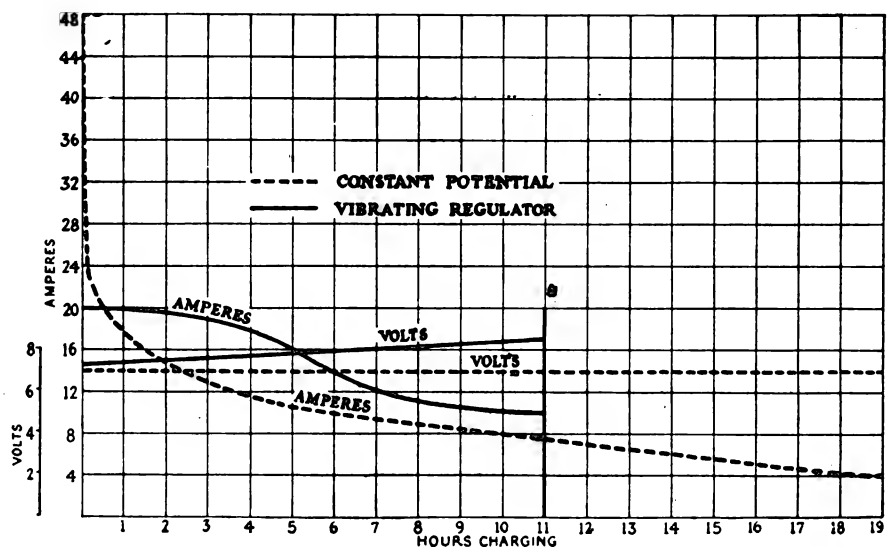
The regulator has, in fact, two functions to perform, dependent upon the battery condition. They are in a certain measure different, but at the same time bear a definite relation to each other. For instance, the voltage of a discharged battery is below that for which the regulator system is set. Consequently, the current which will flow in the circuit will be limited

only by the voltage drop due to the resistance of the various units. A voltage responsive coil alone would not operate in this case, since the potential of the generator will drop to nearly that of the battery and the contacts will not open. At moderate or high speeds, therefore, the generator voltage would be absorbed in IR drop—the current reaching an excessive value.

To overcome this difficulty, a current responsive (or series) winding of few turns is added so that the regulator contacts will be opened whenever the current tends to increase above a definite value. This winding also acts, in a measure, in the form of a reactance, opposing rapid fluctuations of the current and tending to steady the flow. The regulator under these conditions, therefore, is a current regulating device.

On the other hand, the voltage of a full battery while charging is above that of the regulator system setting, and whenever the contacts are closed, the generator voltage attempts to rise and the voltage responsive windings cause the contacts to open. With open circuit and resistance load conditions the regulator characteristics will follow principally those present with a charged battery, since in the one case the voltage responds and in the second case both current and voltage tend to increase.

This compromise does not have such serious faults as might at first appear, but, on the contrary, the situation is improved to a marked degree. The current and voltage responsive means both contribute to a given setting of the regulator with a low battery. On the other hand, in the case of no load (or open circuit) operation, the voltage

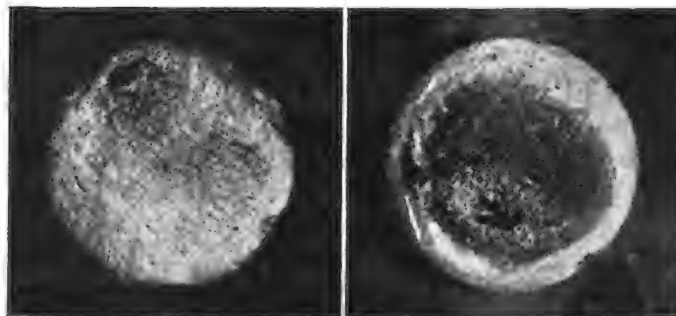


1—Charging curve, comparing vibrating and constant potential regulators

*Engineer, Automotive Engineering Department, Westinghouse Elec. & Mfg. Co.



2—Picture of regulator and cutout.



4—Microphotograph of contacts.

must rise slightly to compensate for the loss of the pull formerly contributed by the current winding. In actual battery charging, this combination cuts down the initial current, but raises the final current, since the voltage has also risen slightly. Consequently, the battery is charged at a faster average rate than in the true constant potential system as will be seen by Fig. 1. No harm can come from this method as long as the final rate does not exceed a value of current which a fully charged battery can receive continually without destructive gassing or heating.

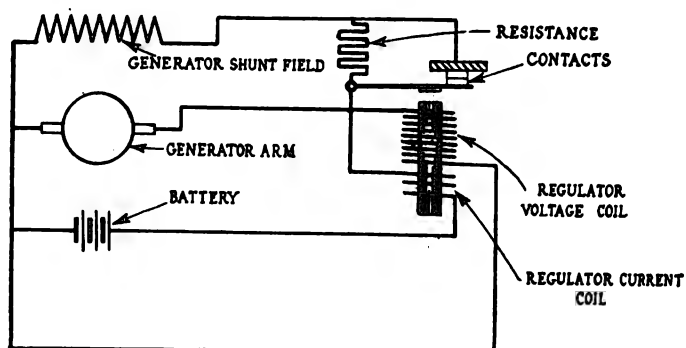
The use of vibrating voltage regulators for governing the output of generators is by no means new. They are commonly met in power generating stations for the purpose of keeping constant the line voltage of the generators, regardless of the load being used. Many other types of these regulators will be found serving varied purposes—power factor regulators, load distribution regulators, railway car lighting, etc.

The introduction of the vibrating type regulator to automobile generators, in quantities, dates back to about 1912, and this regulator is still in active use in many systems. Many variations and adaptations of this type have been devised and offered, and considerable ground has been covered in the art. The earlier types of regulators

Perhaps the most vital and difficult to overcome is the sticking or freezing of the contacts, inasmuch as failure at this point means an excessive rise in output and liability of ruin of both the generator and battery. On the other hand, the attempt to cure the fault should not swing too far in the other direction, and interpose high resistance contact conditions in the field circuit such that the generator cannot deliver its output. The best combination seems to be, as with a shaft and bearing, a relatively hard contact and a soft contact, the hard contact being the movable member. For this purpose tungsten and silver are used, the latter forming the positive contact. A slight rubbing effect should be imparted, and to accomplish this the armature carrying the movable contact is mounted on a very thin leaf form of hinge and the contacts are set at a 45 deg. angle. This gives the desired wipe, not enough to cause grooving, but sufficient to have a cleaning effect and prevent the building up of tips in the silver. The angle also permits the displaced material or oxide powder to be brushed from the contact surfaces. Other combinations of inexpensive contacts have been tried without improvement in the results. Perhaps the only case worthy of special mention were two similar tungsten contacts. These were free from sticking, but after a short time tungsten oxide, which is an insulator, formed on the face of the positive contact and ultimately inserted too great a resistance into the field circuit, interfering with generation.

Condenser in Shunt to Vibrator

The use of a condenser, with and without series resistance to change its time factor, has been tried (and in some cases with apparent success) for the elimination of the arc which is drawn each time as the contacts are opened. A peculiar observation in this connection is that in many instances contacts will stick with great persistency even when no arc is discernible, while in other cases a destructive arc may be present and the contacts never stick, but rather fail from being consumed by the arc. It was almost invariably noticed that the sticking occurs in charging a low battery; i.e., in the case where the battery voltage is below the system voltage and the regulator is controlled by the current winding only. This leads to the assumption that in such cases the generator voltage collapse, on the opening of the contacts, is so rapid that the contacts are in reality not opened except sufficiently to draw an arc and maintain it, until the metal is volatilized and finally fuses. In order to overcome this point, it is therefore necessary to so proportion the regulator parts that a very strong pull is always exerted on the contacts. As a further proof of this point, a regulator which ran successfully for 1800 hours on a resistance load failed in three minutes when connected to a discharged battery. In the resistance load charging, the voltage varied sufficiently to permit the contacts to actually open and close so as to disrupt the arc, and no difficulty was encountered.

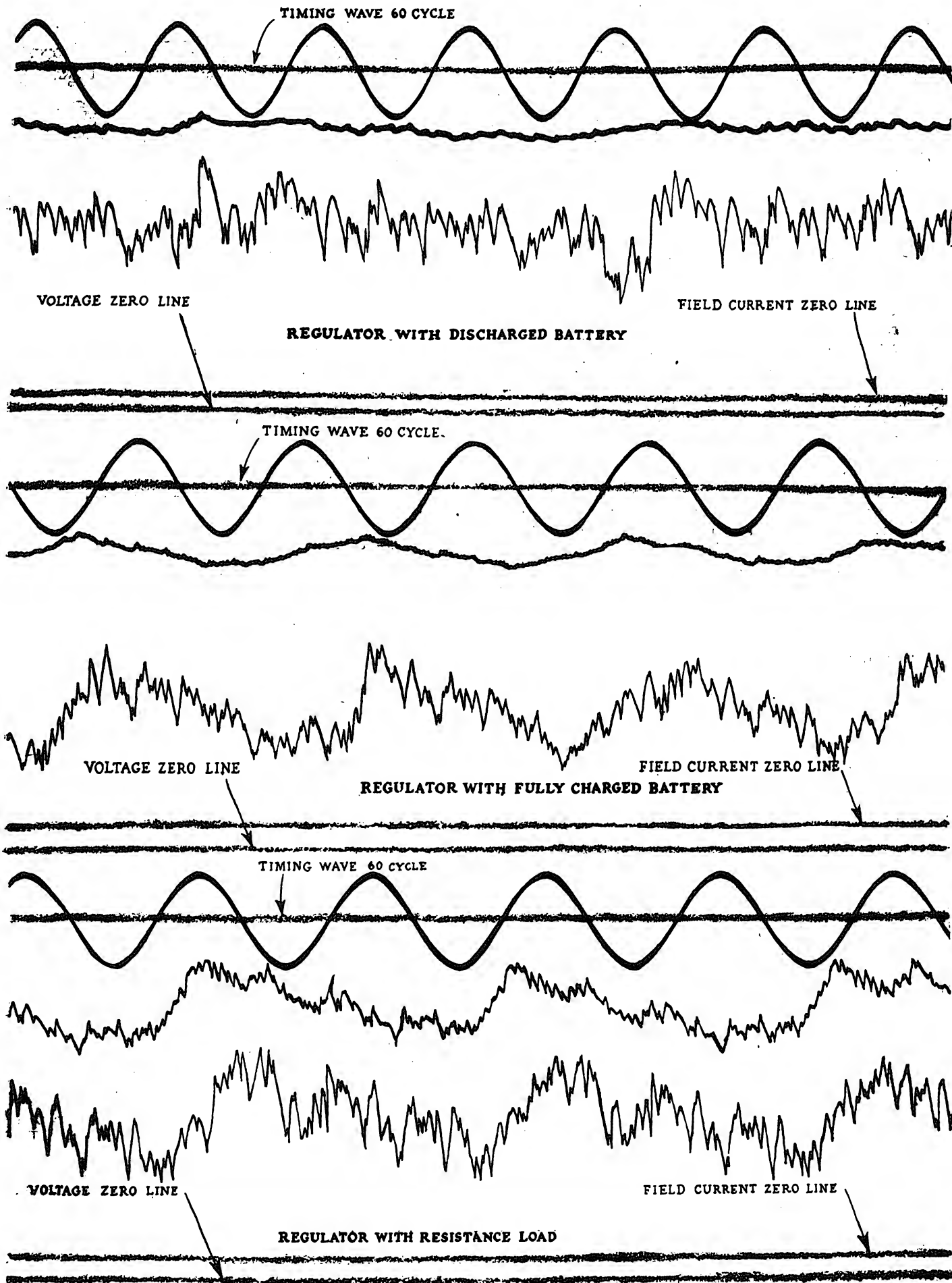


3—Diagram—elementary regulator.

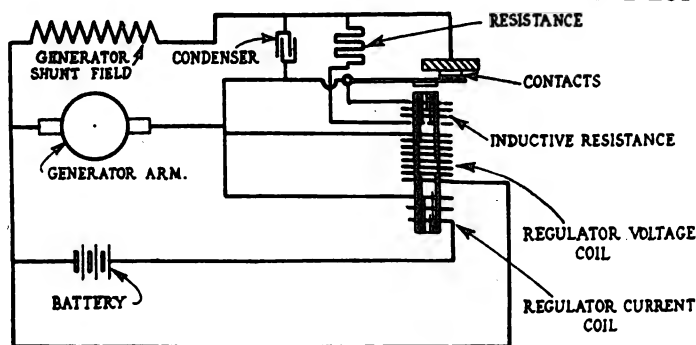
were subject to numerous failures which for a time threatened the popularity of the system and nearly caused its abandonment in favor of the other types with methods of regulation having non-movable parts.

Causes of Early Failures

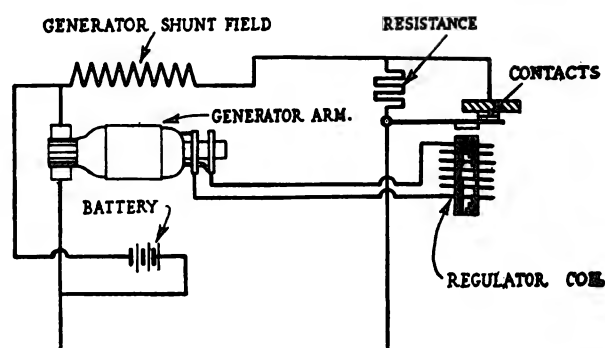
The main causes of failure were either mechanical, sticking or freezing of the contacts, or variations in output caused by the settings changing. At first glance, the problem would appear to many to be the simple matter of causing a pair of contacts to be opened and closed rapidly, in order to insert resistance intermittently into the generator shunt field circuit, and thereby control the output, holding it at an average value equal to the desired amount. However, there are many intricate problems which present themselves in the designing of a successful regulator.



7—Oscillogram of straight regulator.



5—Diagram with inductive resistance.



6—Diagram with A. C. tap.

It was thought possible at first to overcome this point by winding a part of the resistance cumulatively around the core, so that when the contacts parted, the inductive voltage would cause a momentary rush of current in this winding and increase, temporarily, the magnetic pull so as to insure the positive opening of the contacts and thereby damp out the arm. In fact, the idea worked too well, the contacts were opened widely each time, but the frequency of vibration was reduced to a very low order, so that the current variations were too great, and, lastly, an arc was produced each time which rapidly consumed the contacts. Variations of condenser capacity within reasonable sizes failed to alter the spark appreciably. However, failure from sticking was entirely eliminated, proving that the arc itself is not always the controlling factor, but rather that it is the steady maintenance or floating of the arc which causes the damage.

Another method, which has been previously tried, is to excite the regulator shunt field with either A.C. or pulsating D.C. current, obtained from taps on the armature whose voltage it is desired to regulate. The effect of this is to hammer the contacts, since the exciting voltage and current rises above the average voltage each cycle and also drops to zero. This positively insures the opening of the contacts each time, but introduces complications in the generator armature. Other electrical difficulties, particularly at high speeds and with fully charged batteries, were encountered in the regulator characteristics. One noteworthy feature in this connection is the fact that with the A.C. type of excitation it was possible to use both contacts of tungsten, because the hammer effect jarred

any formation of oxide which tended to form, from the face of the contacts.

Working in the other direction, a regulator with a heavy pull was designed, which operated correctly as concerns the above observations. However, a tendency of the current to increase would cause the contacts to open widely, so that the armature struck the core. If this repeated several times rapidly, the contacts would be found welded after one of the closings. Removing the condenser entirely removed the welding or sticking. In this instance the effect was produced by what is known as percussive welding; i.e., a quantity of electricity is discharged rapidly through two contacts which are pressed firmly together.

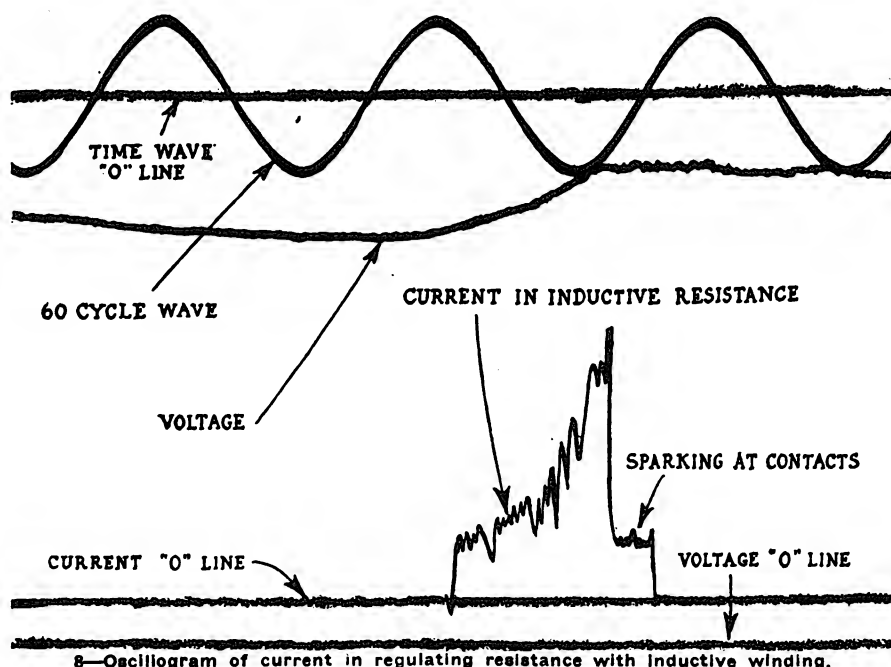
Temperature Compensation

Another problem to be considered is the compensation for the effect of the heating of the regulator shunt coil. The resistance of this winding is raised when heated and in consequence its pull is decreased. To overcome this it is necessary to decrease the counter pull of the spring which holds the contacts together. It has been found in this connection that a certain minimum spring pressure is required to insure that the contacts will properly seat, and that the field current will flow without trouble from contact resistance. Therefore if, to compensate for heating, the spring pressure is reduced to somewhere near this value, the regulator will be unstable and the generator output will vary between wide limits. The pull should therefore be made several times stronger than the required contact pressure, and this ratio has been found to work favorably in this case.

Vibration of the contacts at a high frequency is another desirable feature. It tends to insure stability; i.e., closeness of regulation and the holding of the current or voltage variations close to the average. It also seems to work out well in the problem of sticking contacts, since a strong spring and strong magnetic pull are required to obtain the high frequency, resulting in a more positive action.

Regulating Resistance

The last electrical problem is one of the proper amount of resistance to place in parallel with the contacts. This should be sufficient to control the output at the maximum desired generator speed with a fully charged battery, and yet should not be too great; otherwise, at the lower speeds, when the regulator is just commencing to function, the output characteristic will be unstable and the current (or voltage) will vary between wide ranges until the speed has increased suffi-



8—Oscillogram of current in regulating resistance with inductive winding.

ciently to raise the frequency of vibration to a stable point. Again, excessive resistance approaches the point where the field is nearly open circuited and this will in itself cause inductive arcing at the contacts, which is very destructive.

Lastly, the unit must be mechanically rugged, so that the vibrations and shocks caused by the car motion will not alter the setting or loosen any of the parts. Simplicity and ease of adjustment and repair should be paramount in the design.

A Double Diaphragm Vibrator Horn

A VIBRATOR horn with a double diaphragm, which it is claimed is unusually penetrating and effective, yet not giving a note such as to create offense, is among the newer products of the Robert Bosch Magneto Co., Inc.

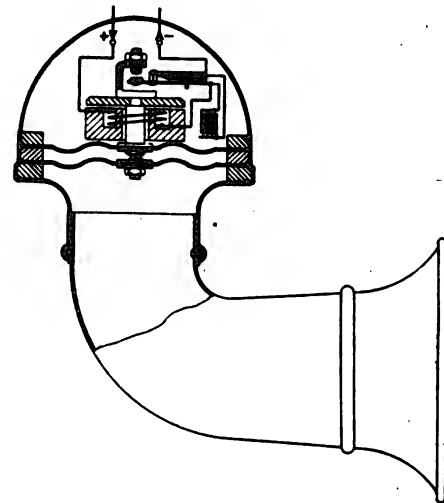
The horn consists of a hemispherical housing containing the tone-producing mechanism, including an electro-magnet, a vibrator and the diaphragms, and a trumpet secured to same. To a clamping band surrounding the housing is secured a flexible member by means of which the horn is supported upon some structural part of the vehicle.

If the horn button is pressed, the circuit of the electro-magnet forming part of the operating mechanism is closed and broken in quick succession. The result is that the armature of the electro-magnet and the diaphragm connected to it are set into rapid vibration, imparting to the air column in the trumpet a rate of vibration which acts upon the ear as a deep note. The diaphragm to which the armature is connected is rigidly held at its circumference by being clamped between two metal rings in the housing. The motion of the interrupter is controlled by the diaphragm, so the vibrations of the two members are synchronous.

Mounted directly in front of the fundamental note diaphragm is located a higher note diaphragm which receives its motion from the former. This higher note diaphragm is claimed to make the tone effective, penetrating and far-carrying. It is claimed that this secondary diaphragm does not produce merely a supplementary noise, but a true musical tone. Owing to the fact that the secondary or high note diaphragm is not loaded with extraneous masses, such as the armature and core, its rate of vibration is much higher, though it is otherwise of substantially the same form as the fundamental note diaphragm. A very exact adjustment insures that the secondary diaphragm is given regular impulses, so that it does not create a noise but a musical tone which, though higher than the

fundamental note, bears a certain relation to it as regards rate of vibration.

Road tests are said to have demonstrated that the tone of the Bosch horn becomes particularly effective through these higher notes. In order that the fundamental note may not be impaired in its effectiveness by the higher note diaphragm, the latter is provided with openings of suitable size and number.



Sectional view of double diaphragm vibrator horn

The fundamental note diaphragm makes about 300 vibrations per second. To the housing of the mechanism is fitted the trumpet, which is bent at right angles and whose length is proportioned to the rate of vibration of the diaphragms. This results in a resonance effect which is claimed to add materially to the fullness of the tone. The trumpet is rotatable relative to the housing, which facilitates the mounting of the horn on the car.

Spring Type Car Door Cushion



Hushadoor door cushion

A SPRING type of cushion for the doors of motor car bodies has been placed on the market recently. Referring to the cut-away view shown herewith, two small but rather stiff springs are anchored in the plunger box, which take up the recoil of a heavy block tongue of rubber. The idea is to reinforce the checking action of the rubber tongue by the springs, and the pressure of the springs and the rubber together when the door is closed is claimed to be particularly effective in holding it against vibration and rattling.

Among the advantages claimed for this design of door check are that it is unusually compact, that it fits flush within its recess, that it is powerful enough to take up the heaviest slam and that it has a double compensating rebound which automatically takes up wear. The cushion is furnished finished in black enamel, nickel or in natural metal, and is the product of the Velguth Metal Parts Co. of Milwaukee.

Methods Used in the Assembling of 150 Engines per Day

A description of the assembling, inspection and testing operations and equipment employed in fabricating the powerplant used in new Jewett car. Special machine is used to simultaneously grind in twelve valves in one minute. Fan brake employed for final run in and block test of engine.

By J. Edward Schipper

IN the manufacture of engines, as in other products, it is essential to see that savings made possible by the utilization of the best machinery and methods in manufacture are not offset by inefficient methods in assembly.

The manufacturer has working with him specialists on machine design. He is also favored by having competition between manufacturers of various types of machines who eagerly work with him for the purpose of cutting down expenses in manufacture, because these men know full well that the machine which makes the best showing from an economy standpoint is very apt, other things being equal, to be the one purchased.

After this machinery has all been purchased and installed, however, the engine manufacturer has on his own hands the problem of efficient assembly. This is practically all manual labor and involves, consequently, an almost boundless opportunity for the introduction of practical motion study and routing.

With this thought in mind, it is interesting to make a study of the assembly system as laid down for one of the newest engines to be a factor in the automotive field. This is the light six Jewett engine which is made in the engine plant of the Paige Motor Car Co., Detroit. This six-cylinder engine is typical of L-head construction and the methods in use are broadly applicable in this field. The cylinder block casting upon which the engine is built is identical with that of the Paige, which is manufactured as described in AUTOMOTIVE INDUSTRIES some time ago.

The first operation in assembly is to press in the camshaft bearing on an arbor press. The cylinder block interiors are then painted with a special sealing paint which is mixed with alcohol to give it the desired quick-drying properties. The paint employed is red crankcase enamel, made by the Royal Varnish Co., Toledo. This provides a clean, interior surface to work upon, any loose coarse sand, dirt, etc., being permanently sealed to the walls so that it becomes a simple matter to wipe out the engine at any point along the production line or by use of an air blast to blow out particles of foreign matter which do not readily adhere to the smooth surface.

On this particular engine, the valves are inclined to the axis of the cylinders. In order to make the top surface of the block, which carries the valve seat, in a plane at right angles to the valve stem, an arbor is used which fits into the valve guide hole and pilots the cutter which is slipped over the arbor, Fig. 1. This is a hand operation which trues the face of the block, making it possible to cut in the valve seat at the proper angle. In order to maintain accuracy, three arbors are provided. One of the three is so sized that it fits the valve guide hole exactly to line up the operation of cutting away the metal for the valve seat.

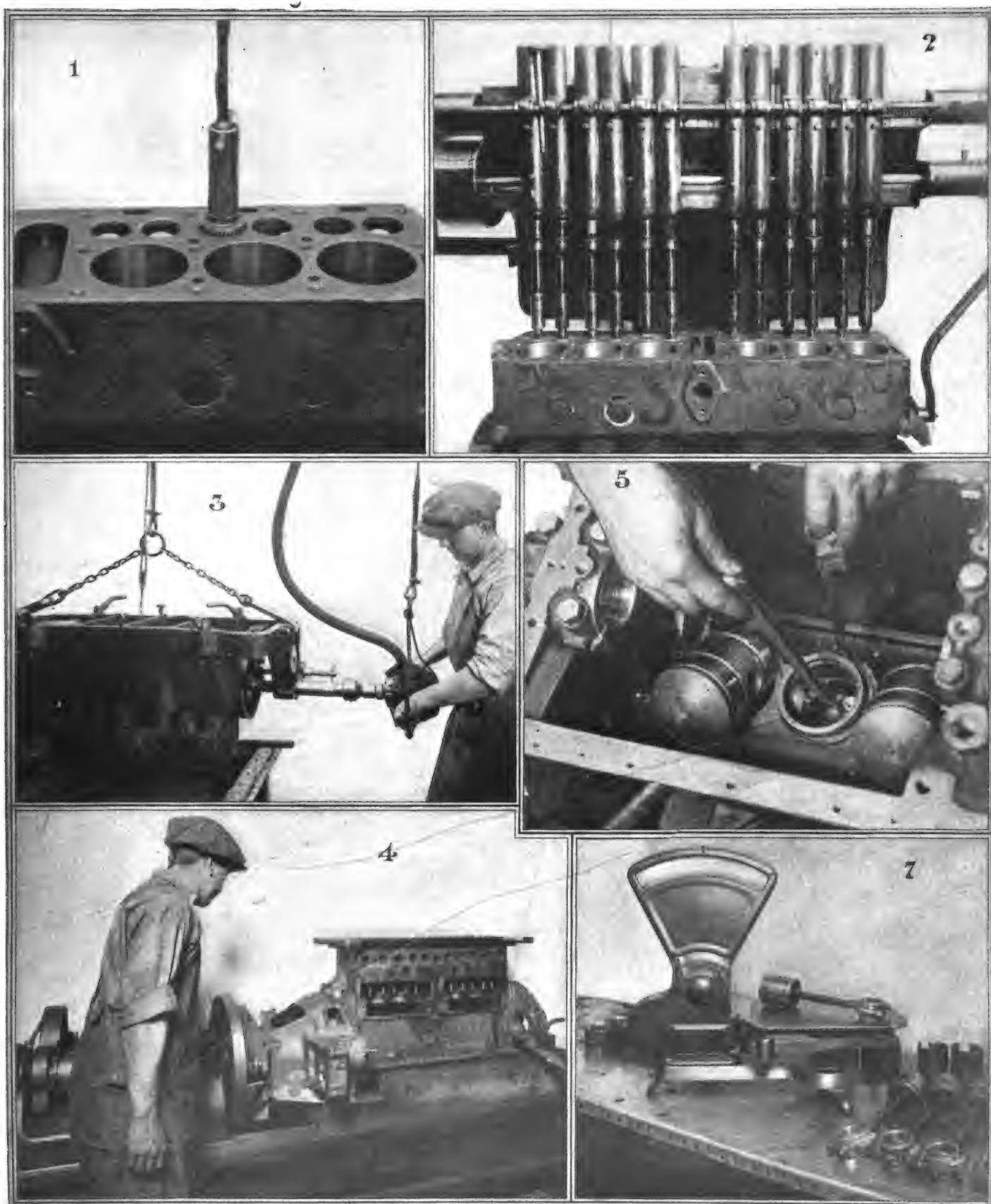
After the preliminary facing by hand, the top of the cylinder at the point where the valve seat is cut is rough faced with an air machine. The valve seat is then rough cut in by hand, and is then given a finish cut with another air machine. This gives a fairly close valve seat and the valves are then selected and stamped with numbers to indicate their position in the block before the grinding operation shown in Fig. 2 takes place. This operation is performed on a special Defiance valve grinding machine which grinds in all twelve valves at a time, giving the back and forth motion used for valve grinding. The twelve valve seats can be ground in 1 minute. After the seats are ground, the block is inspected and the valves all checked with Prussian-blue to assure a clean, even seat around the entire periphery of the valve face.

After the valves are inserted, a false head, which can be seen in Fig. 3, is put over the top of the block to protect the valves and permit the block to be turned upside down and slid along the conveyors without injuring the surface of the block itself. A recess is provided in this false head to prevent contact in any way with the heads of the valves. The main bearings are put in and reamed as are also the camshaft bearings on Martell line reamers, Fig. 3. After the rough and finish reaming operations are completed, an air blast is utilized to clean out the chips. In order to check the reamers, plug gages are put in the bearings of every second case coming through.

The flywheel housing is put on and this housing is then bored and faced for proper alignment with the transmission shaft, Fig. 4. Location for this boring and facing operation is by two dowels which fit into the front and rear main bearings. Thus, the transmission shaft is piloted accurately in alignment with the main crankshaft bearing.

The pistons are selected to fit the cylinder bores by the use of a feeler ribbon, .004 in. thick, Fig. 5. The pistons must fit snugly against this ribbon. The pistons are weighed in manufacture and held within a limit of one-eighth ounce. The fitting of the pistons is followed by an inspection operation for fit, as well as for weight and clearance.

The crankshaft sub-assembly consisting of the crankshaft, flywheel and crankshaft timing gear is then bolted in place. With this in place, the engine assembly is put on a small conveyor. While on this conveyor, which is shown in Fig. 6, a small group of assembly operations are carried out. The conveyor carries the blocks around in a short elliptical path, during which time a few of the units are added to the block. The water pump assembly and the crankshaft, flywheel, connecting rods and pistons are put on and a driver added to the flywheel for belting in pur-



1—Hand tool used for cutting top surface of block at right angles to inclined valve stem axis. 2—Grinding all twelve valves simultaneously on a DeFrance valve grinding machine. 3—Line reaming the main and camshaft bearings for the Jewett engine with Martell reamer. 4—Boring and facing flywheel housing. Location for this operation is on two dowels which are not here visible but which fit into the front and rear main bearings. 5—Fitting pistons into Jewett cylinder block by means of a .004 in. feeler strip. 6—The Jewett connecting rod assembly is held within a maximum variation of $\frac{1}{4}$ oz. by weight, $\frac{1}{8}$ oz. being allowed for the piston and $\frac{1}{8}$ oz. for the rods and bearings



6—Small elliptical conveyor system. The units are pushed along this elliptical track on the racks, as shown, and as they progress, the water pump assembly and connecting rods and pistons are put on and a driver added to the flywheel for belting in purposes. The flywheel is put on with the crankshaft assembly. 8—Fixture used for securing squareness of piston and for taking any bends out of the connecting rods. 9—Engine mounted in rack on final assembly line. The universal rack is so designed that the engine can be tilted to any position. Note that the timing gears, water pump and valve tappet assembly have been put in place. The operator is shown just finishing the operation of putting in one of the valve tappet assemblies. 10—Engine turned upside down on final assembly rack to permit access to oil lines and lower parts mounted before under pan is put on. Operator is shown packing rear main bearing. 11—Final block test of Jewett engine. The flat conveyor which brings the engines to the blocks, is shown behind the engines running along under the window.

poses. The connecting rod assembly, consisting of the pistons and rings, connecting rods and piston pins, has come in from a spur in the assembly layout. The connecting rods are weighed, Fig. 7, and held within one-eighth ounce total weight, the big end of the rod being held within one ounce. Thus, a total variation is allowed of one-eighth ounce for the connecting rod and one-eighth ounce for the piston, giving a maximum variation of one-quarter ounce for the entire assembly.

Selective fits are used for the piston pin, this being a light running fit in the bushing which is located in the top of the connecting rod. The connecting rod bearings are put in place and reamed with a Martell reamer on a gage which is piloted to assure squareness of the bearing holes. These rods are reamed, one at a time, in this jig.

In fitting the piston assembly to the cylinder block, an allowance of .003 to .010 in. is permitted in the ring gap. The connecting rods are checked for squareness on a special gage, Fig. 8, and all of the pistons are measured with micrometer for roundness before they are placed in the cylinder bore. Another precaution taken before putting the piston and connecting rod assembly in the cylinder bore is that they are thoroughly cleaned, this being effected by washing them in gasoline, drying them and then flushing them in oil. After the piston and connecting rod assembly has been fitted to the cylinder block, the unit goes on the stand where it is belted-in, in oil. The length of time this belting in process takes places depends on the condition of the motor and perhaps averages an hour.

The driver, which was attached to the flywheel, is then removed and the connecting rod and main bearing cap bolts are keyed and wired in place. The dummy head is removed and the block is placed on a conveyor which takes it down to the beginning of the final assembly conveyor line. Before starting on this line, which is a traveling conveyor, carrying universal racks for the engines, the blocks are again thoroughly cleaned with gasoline and blown out.

The timing gears are next fitted, these including the cam, water pump and crankshaft gears. The stand is so tilted that these operations are very accessible and inasmuch as the engine can be easily turned over, either the top or

bottom can be worked upon with equal facility. The valve tappet assemblies are put in, as shown in Fig. 9. There are two of these, each taking care of six valve tappets. The studs for different units such as the heads, manifolds, etc., are placed, and immediately following this the head is put on, also the manifold, hot-air stove, plugs, high tension leads, the horn bracket, starter, priming cocks, etc.

As the engine moves along the distributor, coil units and other small units are added with the engine in the upright position. The engine is then turned over, Fig. 10, to provide access for the parts going on the bottom. The front gear cover is put on, all of the oil lines, the oil pump, packing in the rear main bearing, oil float, etc., are put in place. The clutch and gear-set are attached and the engine is taken over to a slat conveyor which runs along the outside wall of the building, carrying it along to the test blocks.

On the way to the block testing stand, the carbureter, name plate, clutch pedals, throttle rods, etc., are put on and the engine is then ready for the test. There are forty of these blocks, Fig. 11, taking care of the production of 150 engines per day. Some engines receive a slightly longer block test than others, as certain requirements have to be met in the way of performance, particularly as regards silence and responsiveness to the carbureter. An average test of approximately two hours is given on the block, a majority of which time the engines are operating under wide open throttle. The engines operate against fan blades, which are carried on the ends of the propeller shafts outside of the building. The load on these fan blades is such that the engine shows r.p.m. equivalent to about twenty-five miles per hour on the road, with wide open throttle.

After leaving the block test, the engine receives another inspection, the tappet covers are put on and other finishing touches given. A final inspection is made just before reaching the shipping room, the latter inspection including the checking of the transmission lock, which is in unit with the transmission. The engines leave this final inspection and are placed on trucks and carried over to the main plant where chassis assembly takes place.

A New Demountable Rim

A RIM in which a single cam takes the place of six or eight lug bolts usually employed to hold a demountable rim in position is being offered for consideration of rim and wheel manufacturers by H. N. Moody.

The wheel band is made with ten wedging surfaces which engage against lugs on the tire rim. These surfaces are brought into engagement with the lugs by relative movement between the wheel band and the rim, brought about by turning the cam. This forces the lugs behind the wedging surfaces and is said to give a high

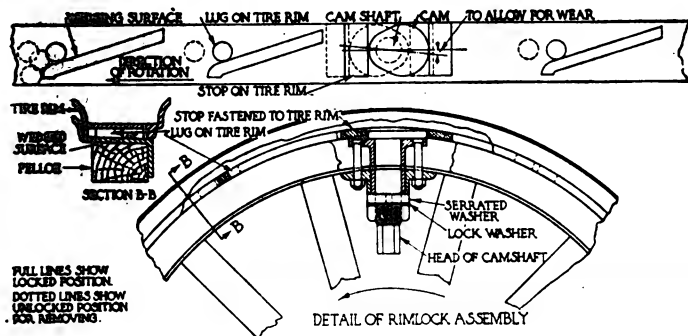
factor of safety against lateral stresses. When the rim is in position, the cam is locked by tightening the nut, threaded over the end of the camshaft, which projects radially inward through the felloe. The nut presses against a lock washer which, in turn, bears against a second washer, the under surface of which is serrated and engages with mating serrations in the sleeve or bushing in which the camshaft turns, as shown in the accompanying cut.

THE Bureau of Foreign and Domestic Commerce reports that the final entry date for the Barcelona Automobile Show has been postponed to May 15. Up to date 13 entries have been made by American firms and 25 by concerns of other nationalities.

The show will be held from May 24 to June 5. The following are the minimum prices for exhibits:

	Pesetas
Passenger cars, 40 cubic meters space.....	2,600
Motor trucks and tractors, 25 cubic meters space	625
Motorcycles, tires and accessories, 10 cubic meters space	450

Additional space will be available at proportionate prices.



Details of Moody demountable rim and tire band showing cam action operated from a single point to lock the rim in place

The Philippines as a Market for Automotive Products

The Islands have felt the depression but a general optimistic feeling prevails. The author describes the present situation as to marketing, roads and financial condition and discusses the local problems in full.

By Roy C. Bennett

THE Philippine Islands, probably the most thoroughly motorized part of the Orient, had a total of considerably more than 13,000 motor vehicles, exclusive of tractors, in operation at the beginning of this year. The last registration receipt issued by the automobile division of the Bureau of Public Works in 1921 showed 13,341. This number included motorcycles. Tractors are not registered with the bureau, and there is no accurate count of their number.

The year 1921 was not an active one for the motor car business in the islands, which fact is accounted for by the general dullness of insular commerce, accompanied by a shortage of money. Some of the largest dealers in automobiles had a close call, although the close of the year found all of them breathing easier, due to the fact that business had picked up to some extent and the prospects were generally brighter. The early part of the year has brought no boom but a general optimistic feeling prevails.

The following is the Bureau of Public Works tabulation of motor registration to the end of the year:

	Old	New	Total
Private cars	5,446	1,020	6,466
For hire cars	1,838	228	2,066
Public utility cars.....	172	5	177
Private trucks	726	146	872
For hire trucks	407	52	459
Public Utility Trucks.....	685	61	746
Garage cars.....	364	33	397
Garage Trucks	207	13	220
Government cars.....	326	49	375
Government Trucks	383	67	450
Private motorcycles.....	682	75	757
Government motorcycles.....	240	116	356
Total	11,476	1,865	13,341

In this table new cars include all not formerly registered in the Philippines, which means that people coming from the United States and bringing their cars with them would register it with the Bureau of Public Works as a new car on their arrival. This is done in relatively few cases except with army people, who can bring their automobiles free of charge on transports, and many officers do so. Some offer them for sale immediately upon their arrival, believing that, due to the cost of shipping which dealers must add to their prices, they can get ready sales. This theory was correct until the slump of business threw a large number of second-hand cars on the market.

Dealers in the islands do not look for any rapid recovery or sudden boom of their business, although they think the worst was passed months ago. Broadly speaking, they are marking time, resting content with the wind-fall sales which come their way and living in hopes that an improvement of business conditions generally will restore health and vigor to their own line sooner or later. The markets for Philippine products started to recover

early this year and there is hope that the movement of Philippine produce, of which sugar is the most important, will improve materially.

Filipinos, who are proud in the extreme, are lovers of automobiles. Manila dealers sell a few cars to Americans and foreigners, but it is the Filipinos who give them the largest business. When sugar was high, Filipino planters had money in quantities they had never before dreamed of, and they bought cars. Hundreds of automobiles, many of them high-priced, went to the provinces, meaning the rural districts.

A car is more of a necessity for the average man in Manila than for the average man in a city of the same size in the United States. Climatic conditions—the heat when maximum and the floods in the rainy season—make it almost impossible for one to walk any distance to and from work. Street car service is inadequate and the street rigs, which are two-wheeled horse-drawn vehicles, are unable to handle the crowds at rush hours.

Relatively fewer persons appear to drive their cars in the Philippines than in the United States, partially because it is customary to have more servants here and partially because chauffeurs are cheaper than at home. Filipino chauffeurs get from 40 to 80 pesos (a peso is roughly a half dollar) a month. They are not the best chauffeurs, particularly as to mechanical upkeep of cars, neither are they particularly poor. The cost of upkeep of a car is about the same as in an American or European city. Gasoline is about twice as expensive, storage is cheaper; tires are higher, but garage charges compare favorably. The climate is hard on cars, as it also is hard on the roads over which they travel.

The status of roads and the history of road building can be understood through a study of the following table from the Bureau of Public Works:

PHILIPPINE PUBLIC WORKS STATISTICS

Total mileage of roads in the Philippines				
	First	Increase	Second	Third
	Class roads	Per cent	Class roads	Class roads
1907	(a) 303	-		
1908	423	40		
1909	609	44		
1910	764	25	(a) 641	(a) 2,074
1911	987	29	664	1,837
1912	1,143	16	1,342	1,999
1913	1,303	14	1,264	1,938
1914	1,593	22	1,258	1,787
1915	1,906	20	1,294	1,896
1916	2,137	12	1,271	2,138
1917	2,323	9	1,278	2,109
1918	2,542	9	1,253	1,944
1919	2,796	10	1,234	1,932
1920	2,920	4	1,266	1,914

(a) No accurate statistics before 1907 and 1910, respectively.

Years preceding 1914 are for twelve months ending June 30, 1914, and following years are for twelve months ending December 31.

Note:

First-class roads in this table include not only First-class roads officially designated but also First-class roads not officially designated as such.

W. Cameron Forbes, strong advocate of road building and a believer in the theory that one of the weaknesses of the Philippines was poor transportation, started extensive highway construction when he was Secretary of Commerce and Police in the Philippines, and when he advanced to the position of Governor-General of the archipelago he made this one of his hobbies. The road system has reached the point where maintenance is a serious problem and engineers are puzzled over the question of the proper kind of road. At present macadam is in the lead, but the heavy traffic, motor vehicles and bull carts, breaks up the surfacing rapidly. The heavy rains in the rainy season do immense damage, while the long dry seasons permit rapid wear through blowing dust.

Cars are used pretty much throughout the islands, but naturally the largest number is to be found in Manila. The drive from Manila to Baguio, a mountain resort, is popular with residents and tourists, as the mountainous part of the drive is scenically most beautiful.

The medium-priced car is the most popular, with the exception of the Ford. However, a number of expensive cars are in use.

Local dealers fear no strong competition from European cars, and the American manufacturer has a sure market, because of the heavy duty on them. This duty amounts to about 25 per cent, and even without this duty the American car is more popular with the Filipinos, who prefer the appearance of American cars, according to a dealer who has handled both and who had several French cars in his salesroom when he made the statement.

Motor trucks are important in the commercial life of

the islands. In the first place they play an important rôle in the freight business. This should be fully understood when one recalls that horses large enough for wagoning are extremely scarce, mules are strangers and the railroad service in the islands falls far short of what it should be. These conditions also have constituted a call for the motor truck to enter the interurban passenger and freight business. It performed its task so well that it has incurred the enmity of the railroad, and remember that the railroad in the Philippines is government-owned. This means that the truck lines, represented in the foregoing table of registrations by "public utility trucks," have the government in opposition to them. Many handicaps are put in the way of the man who wants to start a truck line, if the railroad has a line which might by any possibility be injured directly or indirectly by his competition. It is necessary to get a permit from the government to operate any line of trucks under the head of public utility, and there are a thousand and one technicalities through which the issuance of permits may be delayed or on which they may be denied. This explains why hundreds of applications for permits have piled up in the office of the public utility commissioner awaiting action. The small number of trucks licensed for public utility purposes in 1921 tells the story.

The height to which the price of sugar soared was responsible for an abnormal interest in growing cane. This brought about a heavy demand for modern machinery, including farm tractors. For a time the importer who sold tractors was the one who could supply them fast enough. At that time a good tractor agency was looked upon as a gold mine, but when the sugar business deflated it carried with it the tractor business. To-day the warehouses of importing companies are filled with tractors, and there has been some talk of sending some of them back to the United States, believing that they can be sold there more readily than in the Philippines.

Peru a Market for Tractors

TRACTOR selling in Peru has been retarded by serious handicaps during the past year due to the adverse rates of exchange and to the general business depression, according to a report compiled by the Agricultural Implementation Division, Department of Commerce. Few sales have been made in the past few months, resulting in the accumulation of considerable stocks. The American tractor has a practical monopoly of the market, as it was first introduced and is best known. The only European tractors now offered are the Fiat (Italian), Renault and Somua (French) and the Austin (British). A German tractor was exhibited during the recent centennial industrial exposition, but did not make a favorable impression on account of its apparent clumsiness. The Fowler steam tractor is used to a considerable extent for heavy plowing on sugar plantations.

Only 30 to 35 per cent of the haciendas on the coast are supplied with tractors, so that the possibilities are far from being exhausted. But few tractors are used in the interior provinces. A few are working satisfactorily in the high altitudes, although at an elevation of 10,000 feet or more it has been found that the efficiency of the motor is affected, making it necessary to use large pistons to secure the desired compression. The mountainous nature of the interior valleys constitutes a further obstacle to the use of modern machinery. However, the accessible coast valleys are the most important regions, agriculturally, of the country, and a return to normal conditions may be

expected to be followed by a greatly increased use of tractors and other agricultural equipment.

There are now 14 makes of American tractors represented in Peru. There are few first class houses available as representatives of additional tractors and the manufacturer wishing to enter the market should send his own representative in order to make a satisfactory connection.

With few exceptions all tractors used in Peru to-day are of the wheel type, and any other type, it is stated, is not likely to be purchased without considerable propaganda. The first tractors brought to Peru were of the track-laying type, but did not find favor, possibly due to the fact that the machines were not properly handled and demonstrated. Only one American tractor of this type is on the market, and one European, the Renault, which has but recently been introduced. The medium weight, solidly-built wheel tractor of from 20 to 35 hp. is said to be the best adapted to the average Peruvian plantation. The lighter types have sold well on account of their low cost. Heavy and powerful tractors are not favored, as cultivated tracts are comparatively small. Garden tractors are not used.

Two and three-bottom tractor plows are most common and the mold boards are usually 12 or 14 inches, although the latter is considered by some to be too large. But few tractor disc plows are used, the chief criticism against them being that they break up weeds into such small pieces that their removal with harrows is difficult.

What the Industry Thinks About Used Car Plans

An analysis of answers to a questionnaire sent by the N. A. C. C. and the N. A. D. A. to manufacturers and dealers. A brief outline of the attitude of the industry toward proposals for improving the used car situation.

A VERY great deal has been said on the subject of used cars and there will undoubtedly be more in the future. The value of the matter written has not always been great, but the indirect value, that of bringing the problem out into the open, has had a value which should be more apparent as time goes on. It is necessary that manufacturers and dealers take an interest in the subject if any improvement is to be brought about and one of the best ways to do this seems to be to give wide publicity to ideas and methods which members of the industry are considering or actually using.

In order to determine just how manufacturers and dealers felt regarding the various plans proposed, a country-wide survey was made by the National Automobile Chamber of Commerce and the National Automobile Dealers' Association. This survey was made by sending out a questionnaire bearing sixteen questions. The replies from manufacturers and dealers were taken each as a group and analyzed. Each group was given equal weight and the answers combined to give what may be taken as the industry's vote on each of the sixteen questions.

The results of the questionnaire are given in percentages in the accompanying table.

An analysis of the table would lead to the following conclusions as to the industry's belief in the feasibility of each method:

1. Manufacturers heartily in favor of local appraisers, dealers slightly less so, and the industry standing two to one in favor.

2. Both manufacturers and dealers about equally opposed to dealers' co-operative reconditioning. Four to one against it as a whole.

3. Manufacturers more opposed to manufacturers' co-operative reconditioning than to No. 2, dealers somewhat less, the industry standing against as in No. 2.

4. Manufacturers three to one against factory reconditioning; dealers not quite two to one and the industry not more than two to one opposed.

5. Manufacturers favor dealer reconditioning nine to one; dealers four to one, and the industry as a whole in favor five to one. The industry shows greatest interest and closest agreement on this question.

6. Manufacturers evenly divided on used car exchanges; dealers slightly in favor; the industry seven to six in favor.

7. Manufacturers two to one against trading only own line; dealers about two to one against, and industry two to one against.

8. Manufacturers favor advertising used car value three to two; dealers seven to four and the industry eight to five.

9. Manufacturers opposed fourteen to one against longer discounts; dealers nine to seven in favor and the industry combined two to one against.

10. Manufacturers evenly divided on dealers' co-operative advertising; dealers slightly more in favor and the industry ten to nine in favor.

11. Manufacturers two to one against manufacturers' co-operative advertising; dealers in favor four to three. The industry seven to five against.

12. Manufacturers favor used car guarantees eight to one; dealers about two to one and the industry combined ten to three. Great interest expressed.

13. Manufacturers in favor of used car shows three to one; dealers not quite two to one and the industry slightly more than two to one in favor.

REVIEW OF USED CAR REFERENDUM

	Compared by Percentages												Summary of Vote		
	Manufacturers				Dealers				Combined				Mfrs.	Dealers	Combined
	Yes	No	Doubt	Ans.	Yes	No	Doubt	Ans.	Yes	No	Doubt	Ans.			
1. Local appraisers	63	23	9	5	51	36	6	7	57	29.5	7.5	5	Yes*	Yes	Yes
2. Dealers' co-operative reconditioning..	12	66	11	11	15	67	4	14	13.5	66.5	7.5	12.5	No*	No*	No*
3. Manufacturers' co-operative reconditioning	6	80	3	11	21	55	8	16	13.5	67.5	5.5	13.5	No*	No*	No*
4. Factory reconditioning	17	57	11	15	28	50	6	16	22.5	53.5	8.5	15.5	No*	No*	No*
5. Dealer reconditioning	74	6	14	6	67	16	3	14	70.5	11	8.5	10	Yes*	Yes*	Yes*
6. Used car exchanges	37	37	9	17	45	33	11	11	41	35	10	14	Tie	Yes	Yes
7. Trading own line only	23	63	6	5	30	56	5	9	28	59.5	5.5	7.5	No*	No	No*
8. Factory evaluating used models	49	34	17	0	52	30	9	9	50.5	32	13	4.5	Yes	Yes	Yes
9. Longer discounts	6	83	3	8	48	37	8	7	27	60	5.5	7.5	No*	Yes	No*
10. Dealers' co-operative advertising	40	40	9	11	44	36	6	14	42	38	7.5	12.5	Tie	Yes	Yes
11. Manufacturers' co-operative advertising	23	60	3	14	43	33	7	17	33	46.5	5	15.5	No*	Yes	No
12. Used car guarantees	71	9	17	3	57	29	9	5	64	19	13	4	Yes*	Yes	Yes*
13. Used car shows	60	17	14	9	51	31	9	9	55.5	24	11.5	9	Yes*	Yes	Yes*
14. Accepting dealers prospect estimate ..	46	26	28	0	54	16	10	20	50	21	19	10	Yes	Yes*	Yes*
15. Refusing old truck trades	34	11	9	46	60	11	4	25	47	11	6.5	35.5	Yes*	Yes*	Yes*
16. National used car markets	11	51	9	29	48	22	6	24	29.5	36.5	7.5	26.5	No*	Yes*	No

*Indicates that vote was more than 2 to 1.

14. More manufacturers in doubt than say "no" to accepting dealers new car quota estimate; dealers in favor three to one and the industry two to one.

15. Many did not answer the question of refusing old truck trades, but comparing only the "yes" and "no" votes the manufacturers are in favor three to one; dealers six to one and industry four to one.

16. Manufacturers four to one against national used car markets; dealers two to one in favor and the industry as a whole six to five against.

As may be seen by a glance at the answer to question No. 15, both manufacturers and dealers are against trading in old trucks and the industry is against it with a ratio of four to one. If it is going to be possible to bring about this condition in the merchandising of trucks it would be well to see wherein are the fundamental differences which would permit it with trucks when it is generally considered to be impossible with passenger cars.

The report of the survey goes on to say that many dealers believe that the used car situation is their problem and that the manufacturers can only help in one way, and that, to refrain from overloading them with new cars. If this is done they believe that overtrading allowances will not have to be resorted to. It may be seen by reference to question No. 14 that dealers registered emphatic approval to having manufacturers accept their estimates of new car quotas, believing no doubt that this would indirectly ameliorate overtrading.

In connection with this subject of the manufacturer helping the dealer solve the used car problem it might be well to quote from an article appearing in AUTOMOTIVE INDUSTRIES of Jan. 26, 1922, page 160.

How the Manufacturer Can Help

"Since the actual solution of the problem lies with the dealer the manufacturer's part is to help the dealer and make conditions for him as favorable as possible. This can be done in several ways, important among them which are the following:

"1. General educational methods, showing the dealer the folly of over-allowance from the standpoint of sound business methods and profits.

"2. By urging the dealer to recondition cars properly before making a resale and to give a guarantee with his used cars commensurate with what he honestly believes the performance of the car will warrant.

"3. By urging the dealer to build confidence in used cars by keeping used car sales, service and advertising methods at the highest level both ethically and materially.

"4. By aiding the dealer in market analysis methods; showing him how to properly estimate the buying capacity of his territory. In some cases the manufacturer's organization can make market analyses and pass them on to the dealer for his use.

"5. By aiding the dealer in actually reconditioning cars. This is not practical in every case, of course, but may properly be considered in many instances.

"6. By selling parts for rebuilding cars at a lower price than that charged for regular repair parts.

"7. By planning and adjusting factory production on the basis of comprehensive market analyses, so that there will not be a temptation to overload the dealer."

The report mentions that many emphatically recommend that all manufacturers stop making trade-in allowances to their dealers. Undoubtedly this practice works unfairly to those who do not receive this allowance and it may be said to run counter to the efforts that are being made to lessen the used car evil, namely, to deflate values and put them on a sound basis where values would have a meaning which is readily understood.

"Very many think altogether too much is being made of the used car problem—that it is a bugaboo—whereas actually it is but a business condition for which the manufacturers are somewhat to blame. When new cars go down, the dealer has no protection on his used car, showing dealers should promptly dispose of used cars. The whole business they aver will rectify itself when general business conditions are better."

Some Suggested Plans

The survey report contains many suggested plans which may be well to mention briefly.

Mr. H. H. Brooks, sales manager of the Nordyke & Marmon Co., offers a national used car company plan which is briefly:

"A national used car corporation formed and operated under the supervision of the passenger car manufacturers, dealers and bankers, its sole business to be to buy, recondition and sell used cars. It will have a central headquarters with main branch houses in various zones, according to geographical conditions and potential markets. The branch houses will be reconditioning plants distributed so that cars can be driven in instead of shipped. Sub-branches will be purely retail establishments, except for minor repairs and adjustments. . . ."

A certified car plan was proposed by Homer McKee, the object being that certifying a car would remove the stigma from the used car business, and that a car must reach a certain standard of condition before it could be certified. "The Certification Board would be composed of fair, competent, unprejudiced mechanical experts."

Among other plans proposed are the National Appraisal Company plan, the Scranton plan, Used Car Auctions, Taylor Selling Service, Boston, Saginaw, Oklahoma and Cincinnati plans.

"A rather drastic and perhaps visionary proposal is to retire all cars over five years old, the manufacturers and dealers to provide capital for junking such used cars, the dealer being compensated by saving the expense of carrying used cars indefinitely and being enabled to carry larger new stock and the manufacturer by the salvage of parts usable for service."

The words "drastic" and "visionary" are well advised, for a careful consideration of this proposal cannot help but show up many inherent weaknesses as well as hidden dangers. It would seem impossible to carry out any plan of this nature without causing inflation and other troubles that the industry is trying to get away from.

FOLLOWING is a complete list of the places and countries to which letters may be sent at the rate of 2 cents an ounce or fraction thereof:

Alaska
Antigua
Anguilla
Argentina
Aruba
Bahamas
Barbados
Barbuda
Bermuda
Bolivia

Bonaire
Brazil
British Guiana
British Honduras
Canada
Canal Zone
Colombia
Costa Rica
Cuba
Curacao

Dominica
Dominican Republic
Dutch West Indies
Ecuador
England
Grenadines
Grenada
Guam
Haiti
Hawaii

Honduras
(Republic of)
Ireland
Jamaica
Leeward Islands
Martinique
Mexico
Montserrat
Newfoundland
New Zealand
Nevis
(Leeward Islands)
Nicaragua

Panama
(Republic of)
Peru
Philippines
Porto Rico
Redondo
(Leeward Islands)
Saba (Dutch
West Indies)
Salvador
Samoa
Shanghai, China
Scotland
St. Christopher
St. Lucia

St. Martins
(Dutch part of)
St. Vincent
St. Croix
St. Thomas
St. Kitts
St. Eustatius
Tobago
Trinidad
Virgin Islands
(British)
Virgin Islands
(U. S.)
Wales
Windward Islands



The FORUM



Aluminum, Forged and Cast

Editor, AUTOMOTIVE INDUSTRIES:

I am sorry that Dr. Rosenhain construed my criticism of his article as one of hostility to the proper function of the metallurgist.

I am the last man to raise the question of engineer vs. metallurgist, except to maintain time-honored traditions good for both, as I am very familiar with, and appreciative of, the assistance given by the metallurgist to the engineer. Nevertheless when things go wrong where the use of metals is concerned the engineer is usually and rightly held responsible, so that the metallurgist should consider his recommendations very carefully.

May I remind Dr. Rosenhain that out of a humble effort of mine came the Automobile Steel Standardization Committee of which I was Chairman, thus bringing together the metallurgists and engineers in the British automobile industry as never before to their mutual benefit and the clarification of the automobile steel situation.

Incidentally it afforded me an excellent opportunity of noting how my metallurgical friends differed and disputed with each other upon points that I in my blissful ignorance had thought were settled.

Dr. Rosenhain complains that it is useless for me to "demand vehemently" "that the metallurgist should state the value of all materials in terms of the steel the engineer knows." Misquotation does not help controversy and I would refer him to my letter in your article of December 8, 1921, in which I said "it is particularly the field of the metallurgist to develop the alloys of aluminum and to give to the engineer a clear idea of the properties of these alloys in terms of the materials he is already using and with which he is familiar" which is quite a different thing as the argument is far wider than that of replacing steel by aluminum. This is my vehement and useless demand. It may be useless but hardly vehement.

I would also quote Dr. Rosenhain's statement "Mr. Pomeroy wants to know what takes place before failure begins, but what the engineer really wants to know is at what stress failure really will begin."

Again referring to my letter I actually said "The engineer wants to know what happens before failure commences or rather precisely where it commences on the stress strain diagram?"

I cheerfully agree with Dr. Rosenhain in that my ideas on stress or mechanical hysteresis are distinctly vague. I have read most of the work on this and allied subjects that has come my way for many years past and the further I go the hazier I get. My lack of understanding persuades me that I may be a typical engineer after all!

I had certainly no intention of "attacking" Dr. Rosenhain in general terms for putting forward suggestions as to the utilization of new materials upon which he is an authority, but if it is a retrograde step for anyone to criticise in a perfectly specific manner what strikes him as a very dubious suggestion, then I am all for retrogression not only as an engineer but as a human being. But what really inspired or rather actuated my letter was Dr. Rosenhain's advocacy of the forged aluminum piston

on the grounds that forgings were stronger and more reliable than castings.

This reliability it appears from his last letter is in respect of foundry wasters. I would only say that I am intimately acquainted with a plant which produces more aluminum pistons for automobiles in a week than are absorbed by the whole British industry in three months and that the percentage of machine shop wasters due to foundry defects is less than 1 per cent.

I am prepared to buy Dr. Rosenhain a perfectly good dinner if he will accept it on my next visit to England if his percentage of scrap at the N. P. L. in preparing forged aluminum test pieces with screwed ends is not considerably greater than this. I submit this as an example of quasi production of a simple order.

Dr. Rosenhain's authority is so world wide that I think it a very great pity that he should have advocated the forged aluminum piston *on the grounds* he has set forth. The aluminum piston confers more improvement upon an engine for less expenditure than can be obtained possibly in any other way. It has had its troubles due to causes very remote indeed from those cited by Dr. Rosenhain and these troubles have by patient investigation and unwearied experiment been gradually overcome. I suggest that the best advice to Dr. Rosenhain's production engineer is to get after the foundry and see whether or not the fault lies there.

On the general question of castings and forgings, Dr. Rosenhain is quite mistaken when he thinks my "attack" on him is due to his not agreeing with me on the desirability of employing castings for frame construction. If only he had seen what I have of the fantastic abuse a cast aluminum frame will stand he will realize that his disagreement in face of an accomplished fact would not be a cause for irritation.

He asks me if in pre-aluminum days I would have used cast iron in place of steel. The analogy is, of course, unfair as the alloy used in my cast aluminum frame has considerable ductility and a relatively high tensile strength although not a heat treated alloy, but if I had thought of it I should have investigated a malleable iron frame.

Incidentally may I ask if in the said pre-aluminum days Dr. Rosenhain would have recommended the use of steel pistons for automobile engines in place of cast iron pistons on the grounds of strength and reliability. This is a perfectly fair analogy.

I know the idea of a cast aluminum frame is a little startling, but the first consideration underlying frame design is stiffness rather than strength and the second, reliability of fastenings. The average stress in a frame is really very low and in a cast frame may be more or less uniform. The problem of fastenings with a cast frame is, of course, very simple as most of these can be made integral without incurring foundry difficulties. I suggest that there is no practical difficulty in producing a frame section 4 feet long of 8x2½ in. overall dimensions having a mean thickness of 9/32 in. with box sections at points of relatively high stress. The heavier parts where the sections are bolted together can be chilled without trouble and core prints can be provided ad libitum.

The net result is that in at least one case a frame has been made which weighs some 160 pounds complete while a corresponding steel frame weighs about 300 pounds. Of the reliability and strength of this cast frame I am convinced after some 32,000 miles of brutal testing. I would, however, view with apprehension the task of reducing the weight to say 120 pounds by using forged aluminum on account of the difficulties involved in securing to a comparatively soft and thin section parts such as engine brackets, cross members and spring horns.

I do not understand Dr. Rosenhain's statement that "a different ratio of density to elastic modulus may bring with it unexpected results" in connection with springs. The ratios of density to elastic modulus for forged aluminum and steel are approximately as 106 to 108 respectively and it is difficult to see that this can have much effect.

My calculation is not limited to material under uniform stress but applies equally well to say a laminated spring in which the maximum stress is reached in every section. While experiment frequently reveals considerations not disclosed by accepted theory it is at least worth while to start with some clear idea of the latter.

May I repeat that what the engineer wants is information not necessarily in terms of steel but in terms of the materials with which long experience has brought some degree of familiarity.

The principal difficulties in using modern aluminum alloys broadcast for automobile purposes are not related to their stress resisting qualities, but to softness and lack of wearing capacity and some ingenuity is required to overcome these characteristics. In these matters alone there is ample room for discussion and if Dr. Rosenhain can give us the benefit of the metallurgists' viewpoint and experience I should be very happy to pursue the congenial role of devil's advocate.

Dr. Rosenhain seems to interpret all the engineering problems to which he has referred in terms of the capacity of the parts in question to withstand stress.

Automobile engineering particularly abounds with instances where stress considerations are secondary to others, as for example a crankshaft where stiffness and resistance to wear are the determinants and a low carbon steel crank is amply strong enough in most cases if it would only withstand wear. Similarly with connecting rods, wrist pins, pistons, gears, camshafts, cylinders, flywheels, clutches, hubs, brake drums, frames, etc. Very few of these are stressed at all highly. In fact the principal parts of an automobile which really have to work for their living from the stress point of view are the axle springs, valve springs, transmission shafts and swivel axles, and in most of these be it noted wrought material is used in its very simplest geometrical form. It is this reasoning which underlies the case for the casting in general and the aluminum casting in particular as against the forging for very many parts. Metallurgists in general seem obsessed by the stress resisting qualities of the materials they advocate and specify and in so doing exhibit what is in my considered opinion a lack of realization of the problems before the designing engineer.

I think that if a fraction of the energy which has been devoted to the determination of the straight physical properties of materials had been spent on the investigation of the idiosyncrasies of materials in the fabricated form, i.e. upon macrostructure rather than microstructure, the engineer would have a wealth of data he does not now possess.

If Dr. Rosenhain has the time and inclination to continue this discussion I trust he will do so with two things quite clear in his mind. One, that apart from a certain degree of good humored satire which is the salt of discussion I have nothing other than a profound respect for

the metallurgist, the mysteries of his science and the work he has done; two, that Dr. Rosenhain's eminence is so unquestioned that I hope he will accept criticisms, without regarding them as attacks, personal or otherwise, of suggestions which I venture to think are rather outside his life's work from one who at least can talk from the viewpoint of a fairly extended experience of the problems of automobile design.

LAURENCE H. POMEROY.

The Garden Tractor

Editor, AUTOMOTIVE INDUSTRIES:

In your issue of March 2 there is an article by Fred C. Ziesenheim on the garden tractor. We would like to call your attention to the statement that the writer makes wherein he states a 9-in. plow is a minimum size moldboard plow that can do satisfactory work. We should like to advise that a good many hundred users of our device are doing satisfactory work with the Utilitor handling an 8-in. plow.

Another statement is made that the engine should develop 5 h.p. to handle a 9-in. plow 8 in. deep. This is deeper than it is possible to do good work with a 9-in. plow. Our machine handles a 10-in. plow satisfactorily and we do not have 5 h.p., but 2 1/3 h.p., approximately at the drawbar. It is not a question of horsepower—it is a question of how much traction you can get, and with our job we can slip the wheels with the horsepower available.

Plows, however, are generally considered O.K. when turning a furrow one-half their width in depth.

To further quote this article: "The tractors which cannot pull a 9-in. moldboard plow should be definitely designed and marketed as a non-plowing type until such time as some other form of plow is available which will permit narrower furrows." We should like to ask why. Isn't any machine capable of pulling a plow a plowing type? One which does not handle a plow is known in the trade as a cultivator or a motorized hand cultivator. The writer further mentions the disk type plow for tractors as holding possibilities for small tractors. Why not the moldboard type? Does he realize the impracticability of his suggestion? Does he know what the demands are by a disk plow on a garden tractor? Under ordinary circumstances three, and probably four, horses are required to pull a 16-in. disk plow. These plows are made in 14-in., 16-in., 18-in., and 24-in. sizes.

He further mentions "A proposed method of attachment for small tractors is to place the implements in front of the tractor." Our new model does this. With us it is not a proposed method.

We further take exception to all of paragraph two, on page 508, as it is not based on facts.

Your writer further states that: "The small tractor is not strictly a general purpose machine, as it can only be designed to meet a limited class of service." If there ever was a general purpose machine we think it is the type we make. Can your writer show us a machine of greater utility?

LON R. SMITH, Vice-President,
MIDWEST ENGINE COMPANY.

ANYONE seeking information on the source, structure, chemistry or uses of coal will find a very complete compilation of these facts in the "Coal Manual" by F. R. Wadleigh, recently appointed head of the Coal and Coke Section of the Bureau of Foreign and Domestic Commerce.

This manual will be of particular value to salesmen, buyers and users of coal because it is written in a non-technical, practical way for convenient reference. The National Coal Mining News, Cincinnati, is the publisher.

The Method of Analyzing Territorial Markets

Careful study must be applied to territorial markets and the different factors which have direct bearing on them. In order to make the involved considerations apparent, the method of analyzing markets is applied to a specific company and territory and followed through in each detail.

By Harry Tipper

THE statistics from examinations which have been made previously in these articles concerning the marketing of automobiles and the bases of marketing plans require further extension into the territorial development, in order to show the effect of this consideration upon the layout for the future marketing in the next sales period. In order that the consideration involved may be pointed and specific, we are taking the example of the Jones car, manufactured in Ohio, in the \$2,000 to \$3,000 price group, which company has been securing 20 per cent of the market of this price group with the expectancy of 20 per cent, plus, for 1923 in the total company. The expected requirement for cars in this class for 1923 is 72,000 cars. The expected market for the Jones car for the same period is 15,000 cars. One of the important territories of the Jones car is the Pacific Coast, which has been handled up to the present time by one large distributor located in San Francisco, with branches in Portland, Ore., and Seattle, Wash. This distributor showed the following position for 1921 in each of the three states represented:

CALIFORNIA.—At the beginning of 1921 this distributor had 30 dealers, of which 15 gave up the agency, went out of business or were otherwise eliminated. He has secured 6 new dealers, so that at the beginning of 1922 there are 21 dealers in the State of California. The expected market for the Jones car in California for 1921 was 750. The sales of the distributor were 650, of which 30 per cent were at retail in San Francisco—or 195 cars—leaving 455 cars sold at wholesale through the dealers. The 15 dealers who remained on the books throughout the year took 320 out of the 455 cars, or an average of something over 20 cars each. The 15 dealers who went out during the year sold between them 75 cars before they went out, while the 6 new dealers put on during the year sold 60 cars.

WASHINGTON.—At the beginning of 1921 this distributor had two dealers, one of whom went out of business. The expected sale was 75 cars; the actual sale was 100 cars, of which 80 were sold at retail by the Portland branch; 15 were sold by the dealer who remained in business, and 5 were sold by the dealer who went out before he gave up the agency. No other dealers had been secured at the end of 1921.

OREGON.—The distributor's branch had three dealers, two of whom went out in 1921 and one was secured to replace. The expected market was 110 cars. The actual sale was 100 cars, of which 50 were sold at retail by the branch; 25 were sold by the dealer who remained

in business through the year; 15 were sold by the two dealers who went out and 10 by the dealer who came in to replace.

In order to maintain its position on the Pacific Coast, the Jones company must conduct the following business through their distributor:

CALIFORNIA.—	The present number of dealers	21
	Expected mortality	6
	New dealers to be secured	15
	Number of dealers required	30
	Total sales of cars in this price group for 1923	4,692
	Expected sale of Jones car for 1923	938
	Expected sale at retail by the distributor in San Francisco	300
	Cars to be sold through dealers	638
WASHINGTON.—	Present number of dealers	1
	Mortality (not figured)	
	Number of dealers required	2
	Total sales of cars in this price group for 1923	411
	Expected sale of Jones car	105
	Probable sale through branch	75
	Sale through dealers	30
OREGON.—	Number of dealers at the end of 1921	2
	Expected mortality	1
	Number required	3
	New dealers to be secured	2
	Total sales of cars of this price group for 1923	576
	Expected sale of Jones car	130
	Probable sale through branches	50
	Sales through dealers	80

In view of these facts it is necessary for the Jones Company to determine whether the present organization for distribution will be able to secure the number of sales to be expected from the market conditions. The weakness in the sales of 1921 through California and the large mortality in the dealer organization in that state must be overcome by better contact with dealers and through the effectiveness of the merchandising plans, and by intimate consideration with the distributor of the measures to be taken to overcome that weakness. The Jones Company, through all their territories, will need the same information in order to lay plans for the whole company on a broad basis that will have in mind strengthening the dealer organization in order to lessen the mortality and increase the stability of sale, developing the facts as to the dealer's position so that the arrangements and contracts will enable him to make a reasonable profit and assure him of

reasonable support. The considerations will involve all questions of service, contracts, used cars, and all the other problems connected with the retailing of the automobile in each individual case, but the country-wide program will be concerned with the problems of maintaining an intimate contact with the trade so that changes in agencies can be made without expensive interludes, losses of value through the character of the dealers, or other items. The contact should be so thoroughly established that the mortality will be lessened because a better class of dealers can be secured. Analysis should include the consideration of the means to be taken to increase the actual sales to the expected quota, the establishment of quotas in accordance with the expected sales, and the actual strength of the dealer organization in each locality, and matters of this kind. On the basis of such figures, a reasonable basis can be arrived at for all business with the trade and for all promotion to the trade.

The mortality statistics of the dealers should be compared with the general statistics of mortality for the year in the automotive field, so that the difference between the mortality shown by the Jones Company and the mortality of the general field can be considered as to its indication of weakness or strength in the Jones Company's distributing plan. For instance, if the mortality in the United States among car dealers for the year 1921 was about 50 per cent, the mortality as shown for California, Oregon and Washington is not out of the way and does not indicate any special weakness or any unusual strength in the distributing plans of the Jones Company. Other territories may show a larger mortality in which case the reasons for this increased mortality should be examined. In some territories the mortality may be less than the average, in which case the reasons for the particular strength should be determined.

The weakness in the Jones Company's distributing plan, as it stands at present, lies in the inability to secure a sufficient number of dealers to replace those that have gone out of business or given up the agency. The general statistics in the automotive field show that there were about as many car dealers at the end of the year as there were at the beginning of the year. In other words, new dealers come in or new people take on agencies in sufficient numbers to offset those going out. On the Pacific Coast, the Jones Company has not been able to secure a sufficient number of dealers to offset the mortality due to those

actually going out or giving up car agencies and the consequence is that the number of distributing outlets is now considerably smaller than it was at the beginning of 1921.

The same comparison should be made for each territory so that the plans for sales and promotion activity in 1923 may be arranged to take care of these conditions and provide a proper number of the right kind of distributing outlets, before the quota is established for the Pacific Coast distributor by the Jones Company. The entire United States should be classified in the same way that these three States have been classified and measures to correct the weakness of sales should be determined so that they may be taken into account in dealing with the quota question and the other questions that will arise with this distributor.

It may be that the Jones Company will find the loss in the total number of dealers confined to this territory,

and that in the other territories those dealers going out have been promptly replaced by others coming in. In that event, the particular weakness is local and additional pressure may be necessary from a local standpoint by a discussion of the distributor's plans of action and his methods of dealing with the retailers. On the other hand, if the same condition shows up in other territories, whether to the same extent or not, the general plans of action will necessarily include more pressure on the dealer population in the automotive field so that the Jones proposition may be thoroughly understood and a keener examination made of the proposition itself so that the company may be assured that it is of the

ALL questions of service, contracts, used cars and all other problems connected with the retailing of an automobile should be considered in each individual case, and the contact with the trade should be so thoroughly established that dealer mortality will be low due to securing a better class of dealers.

Analysis should include the consideration of the means to be taken to increase actual sales to the expected quota, the establishment of quotas in accordance with the expected sales and the actual strength of the dealer organization in each locality. On the basis of such figures, a reasonable basis can be arrived at for all business with the trade and for all promotion to the trade.

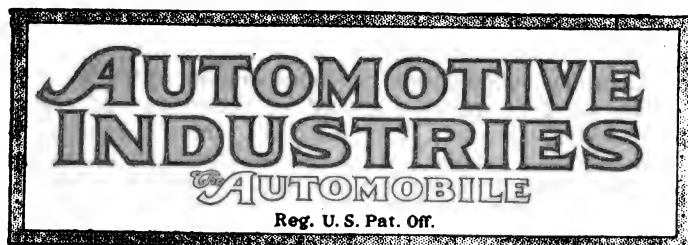
right kind to attract the efficient dealer.

The whole question of sale depends upon the maintenance of the proper distributing outlets and the weakness of the Jones distribution in California is reflected in the failure of the sales to reach the expected number of cars. There is no evidence in the statistics that the sale will be more likely to reach the expected number in 1923 unless the dealers are sold more thoroughly on the value of the Jones proposition and the distributor is equipped to take proper care of them. More and more, the importance of adequate and stable distribution becomes visible; consequently, the Jones Company should collect statistics upon this point with the utmost care, at the same time determining the reasons for the strength and weakness that may show up in the different territories.

Italian Motor Car Taxes Reduced

UNDER a socialistic impulse the Italian Parliament some time ago passed a law imposing such a high tax on privately owned motor cars that the future of the industry was seriously threatened. A car rated at 10-15 hp. is taxed at \$240, nominal exchange; 15-20 hp. at \$450 and a six-cylinder 24-hp. car, \$950. After two years' experience the Italian authorities have realized that high taxes are not only seriously handicapping the motor movement, but that they are less remunerative to the State than the more moderate taxes in force before the war. In consequence, a technical commission pre-

sided over by the Under-Secretary of Finance has decided on a reduction of 50 per cent on the motor taxes applied to small and medium-powered cars, as well as to motorcycles and motor-assisted bicycles. It is also proposed to abolish all taxes on electric cars for a period of five years, providing the vehicles are of Italian construction. There will be some reductions in the taxes on motor trucks, although these imposts have never been high compared with private cars. As an example, a 1½-ton truck is at present taxed only \$65 per annum, while a private car of the same engine size pays \$1,000.



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Exports Picking Up

STATISTICS pointing out the improvement that has been accorded to the automotive industry are always of interest and value. Consequently a good deal of satisfaction and assurance for the future may be obtained from the following figures as to the international business in American passenger cars during the month of February:

Shipped from the United States.....	3096
Shipped from Canada.....	2719
Ford assembly at Manchester, England (both cars and trucks).....	2000
Ford assembly at Buenos Aires, Argentina (both cars and trucks).....	1245

The total is 9050, a figure that has not been approached in our foreign trade for many months. It would be materially larger if the Ford assembly at Sao Paulo, Brazil; Cadiz, Spain; Bordeaux, France; Copenhagen and other cities were added. However, these statistics reveal United States and Canadian shipments of 5815 passenger cars, to which an additional business of 718 trucks were sold from the two

countries. Going back into previous shipments, the last month with a comparable total was January, 1921, with 5249 passenger cars, and December, 1920, with 7753.

Stow the Hammer

THE entire automotive industry has suffered much from adverse rumors during the period of business depression. Many rumors have been founded on fact, but more have been started by persons speaking unthinkingly to those who assumed that the remarks were made in good faith. So it behooves us all to refrain from knocking when we do not know the facts.

It is the duty of a concern to be a credit to the community in which it is located and at the same time any concern which does conduct itself with credit deserves outspoken moral support. This applies to our competitors as well as ourselves, for the strength of the industry depends on the strength of the individual concerns. This may be carried to the ultimate point by saying that that which benefits the community benefits the nation as a whole.

In the days to come let us not forget that the industry needs an every-day application of the old adage: "Stow the Hammer and Sound the Horn."

Automatic Production

MOST industrial ills are the result of a failure to understand the fundamental processes of human and economic laws. Present necessities frequently loom up so large because of proximity that their true relative importance is obscured. The difficulties arising from this fact can be readily traced through the marketing, production and labor problems of the automotive industry.

The predominance of automatic machinery in modern industry, for example, has unquestionably reduced materially the necessity for individual skill and for individual responsibility on the part of the worker. This trend has produced increased efficiency in production up to a certain point. Consequently, many engineers are assuming that this efficiency will continue to increase in proportion as the development of automatic machinery progresses and the necessity for the exercise of individual judgment and responsibility grows constantly less.

A more comprehensive study of fundamentals, however, shows this theory to be a fallacy. There is a very definite point at which, even from the immediate production standpoint, the monotony and nervous fatigue of repetition work offset the increased efficiency gained by the worker in repetitive production processes.

Stepping outside of the individual shop, moreover, the effect of maximum development along present lines will be to slow down the mental process of the mass of individuals comprising our civilization to a point where the necessary leaders and foremen could be obtained, to where the lack of interest in the work in hand will be so great as to offset the production efficiency gained by repetitive work, and to where

industry and production will suffer from a gross inefficiency, unlike pre-machinery inefficiency in kind, but equal to it in degree. As the responsibility of the individual worker is decreased, the necessity for supervision increases.

The purpose of industry is to serve the individuals comprising the human race. It is fundamentally incorrect to assume that man is to serve industry. Procedure based upon this latter assumption, if persisted in long enough and spread over a wide enough area, can result only in revolt—gradual or sudden—according to the strength of the economic forces operating in opposition to human desires and necessities.

That factory will operate most economically over a long period of time which provides within its working program the best opportunity for individual mental and intellectual development among its employees.

Necessary Statistical Data

THE need for accurate statistical data in the automotive industry is greater than ever before. The thorough study of marketing costs and distribution methods which must take place calls for the compilation and segregation of data that has previously been considered unnecessary. Production schedules must be correlated with sales possibilities and a proper balance of all organization activities must be obtained. The necessity for a detailed analysis of many of these problems has come to the industry only recently.

Comprehensive statistical data can be provided only through the concerted efforts of all agencies within the industry. There should be a wide exchange of experiences and of the results of surveys. Marketing studies should be made by many companies and co-operation encouraged in correlating the results of such studies. The field is almost virgin and the necessary development along these lines will be much more rapid if experiences and data are freely exchanged. The result will be advantageous to individual companies as well as to the industry as a whole.

Valve Capacities

IN automobile engines the inlet and exhaust valves generally are of the same diameter and also have the same lift. Designers undoubtedly have been led to the use of equal sized valves by the advantages of interchangeability and to equality of lift by the consideration that the lift should be made as high as possible and still have substantially noiseless operation at maximum engine speed.

The question has sometimes come up in the past, especially in connection with racing engines, as to which should really have the greatest capacity, the inlet or the exhaust. Judging by practice when valve capacities are unequal, the impression has prevailed that the inlets should be the larger or have the largest capacity. Until recently there seems to have been no experimental data on this available to the public.

The problem is somewhat involved, as there are conflicting requirements. In a racing engine or other type which operates under nearly full load all the time, the size of the exhaust valve is limited by the

ability to cool it effectively, and we therefore find cases where two exhaust valves are used per cylinder and only a single inlet valve, which might create the impression that the exhaust capacity should be larger than the inlet capacity. There is, of course, no use in making the exhaust valve so large that it cannot be cooled, but this difficulty can always be avoided by using dual and triple valves, and does not affect the question of the relative valve capacities required at all.

Some light has been thrown on the above question by experiments made at McCook Field and reported in a recent S. A. E. paper by S. D. Heron. The experimental engine had two inlet and two exhaust valves to the cylinder and could be operated with all four valves, with two inlet and one exhaust, with one inlet and two exhausts or with only a single inlet and exhaust. The inlet and exhaust valves were not of exactly equal diameter and lift but were not very much different. It is interesting to note that the engine developed considerably more power with two inlets and one exhaust valve working than with one inlet and two exhausts.

That such would be the case might be expected, for the reason that the charge has to be drawn into the cylinder under comparatively small pressure, while the bulk of the exhaust is forced out under a high one.

Further confirmation of this relationship was furnished by tests in which only a single valve of each type was used. This, of course, gave very small valve capacity in proportion to the size of the cylinder. One of the valves was $1\frac{3}{8}$ in. and the other $1\frac{9}{16}$ in. in diameter, and the lifts were the same for both. With the bigger valve for the inlet the engine gave approximately 10 per cent more power than when that valve acted as the exhaust. Thus it seems to be established that for maximum power the inlet valve should always be larger than the exhaust valve; or, to express the matter in a somewhat different manner, if an engine has inlet and exhaust valves of substantially the same capacity or size, more can be gained in the way of power by increasing the inlet than by increasing the exhaust valve size.

Progressive Conservatism

THE upward trend of car and truck production is in itself sufficient to warrant considerable optimism as regards the automotive industry during 1922. But conversations with factory executives reveal an even more fundamental reason for predicting sound progress from now on.

Factory executives throughout the industry are speaking in conservative terms concerning immediate production and sales possibilities. They are not overconfident; they recognize the limitations of the present upward trend of business and are laying future plans on a sane, conservative basis. Predictions concerning production probabilities are being made on a conservative basis that indicates sound progress.

If this same conservatism that undoubtedly pervades the minds of automotive executives could be translated into the publicity statements sent out by the various concerns, public opinion would be molded more favorably toward the automotive industry.

Outlook Bright for Second Quarter

Volume of Business Likely to Increase

April Will Be Better Than March
—May and June Probably Will
Show Further Gains

BY JAMES DALTON

NEW YORK, April 11—The automotive industry enters the second quarter under decidedly encouraging auspices. Orders on hand, factory schedules established and orders given for supplies, make it certain that April will be as good as March, if not better. Parts makers already have received commitments which indicate that there will be no slackening in May. Prospects for June are good.

If sales continue at the present rate for another three months it would be surprising if there were not a mid-summer decline in business. Such a seasonal falling off has been perennial in the industry except for the last two years. There was none in 1921 and in 1920 it came in the second quarter.

Manufacturers and dealers are just beginning to realize how big a month March was. To find a parallel it is necessary to go back to March, 1920, which was one of the three or four best months the industry ever had. All carload shipment records since that time were broken last month. They were materially larger than in any month of 1921 when the highest total was in August with 20,350. Last month's total was approximately 25,000. The biggest month in 1920, after March with 29,326 was August with 23,886.

March production by Ford was more than 70,000 and it is expected to reach 100,000 this month. The other large makers showed a greater gain over February than did Ford.

One of the most encouraging incidents for the week in the whole industrial field was the reopening of the Ford assembly plant at Atlanta after being idle for a year. This step was justified by a 100 per cent increase over February in sales in the Southern States.

A conservative estimate of the volume of sales for the industry as a whole in 1922 would be something like the following:

Passenger cars: At least equal to

Business in Brief

NEW YORK, April 11—Confident forward steps have been taken in the last week by such basic industries as building and its related lines, iron and steel and agriculture. Retail trade has felt the impulse of spring. This has been reflected in jobbing and manufacturing lines.

A great boom in building continues. Expenditures in 109 principal cities for March were \$194,661,072 as against \$99,219,326 for February and \$91,875,757 for March a year ago.

Bank clearance for the week ending April 6 aggregated \$7,191,119,000, a gain of 16.8 per cent over the preceding week and of 11.3 per cent over the same week last year.

Pig iron production in March totaled 2,034,794 tons, compared with 1,629,991 tons in February. It was the first month since January, 1921, to pass the 2,000,000 mark. Orders for steel products as a whole have been heavier in the last two weeks than at any time since 1920.

Stocks continue buoyant, bonds higher, exchanges steady and time money slightly easier.

With favorable weather winter wheat has improved in all sections. Private estimates of yield are from 550,000,000 to 580,000,000 bushels. Prices in all grain markets showed gains for the week.

Official statements by 935 Iowa banks show that conditions have improved considerably.

Textiles have continued quiet in primary markets.

Car loadings for the week ending March 25 totaled 846,035 with 508,653 loaded with miscellaneous freight and merchandise. This was an increase of 10,996 over the preceding week for the same classes of freight and a gain of 61,956 for the same week of 1921.

1921 and probably considerably in excess.

Light trucks: An increase of at least 200 per cent over 1921.

Heavy trucks: An increase of at least 100 per cent.

Tractors: An increase of at least 200 per cent.

Parts and accessories: An increase of at least 100 per cent and probably much more.

Tires: A considerable increase.

Ford April Schedule Is Placed at 101,164

Will Exceed Last Year by 10,000
—Other Plants to Increase
Production

DETROIT, April 10—The production schedule of the Ford Motor Co. for April closed with 101,164 cars and trucks, which will exceed last year's production by 10,000. An increase of 200 men daily has been made for two weeks at the Highland Park plant, and the employees now total nearly 40,000 men. Tractor production has reached 400 daily.

Ford officials say that the business now in sight will justify making 110,000 cars and trucks. The Canadian factory is expected to run at its capacity of 225 cars a day for the next three months.

General Motors, with a combined output of 66,000 cars for the first quarter, will materially increase production the second quarter.

The estimated production of Dodge Brothers for the second quarter is 52,000, or more than double the second quarter of 1921.

Hupp shows 6344 cars for the first quarter and expects to make 12,000 in the second, as against 4500 in the same period last year.

Packard made 2234 cars and trucks in the first three months of 1922 and expects to turn out 4000 in the second quarter, as against 2200 the same period last year.

Maxwell has a schedule of 200 a day, or a total of 15,000 for the second quarter, compared with sales of 4500 in the second quarter of 1921.

Willys-Overland is turning out 400 cars a day, or at the rate of about 30,000 for the second quarter, which will double the second quarter of 1921.

QUARTER'S OUTPUT, 207,560

NEW YORK, April 10—In the first quarter of 1922, with March partly estimated, members of the National Automobile Chamber of Commerce produced 207,560 cars and trucks, which was 220 per cent of the same period for 1921. All manufacturers reporting produced 371,798 cars and trucks in the first quarter, which was 162 per cent of the same period for 1921.

AUSTIN PAYS OFF RECEIVER

LONDON, March 27 (by mail)—Austin has just paid off the receiver and is now in a flourishing condition. Orders, exceptionally large in number, are coming in at a good rate, and last week's turnover was the best for 12 months.

Production Trend Steadily Upward

Indianapolis Plants Going Ahead Rapidly

March Reports from Manufacturers Indicate That February Was Far Surpassed

INDIANAPOLIS, April 7—There has been a sharp upturn in automotive manufacturing in Indianapolis during the last few weeks. Reports for March from a dozen representative manufacturers of cars, parts, accessories and engines show that March records far surpassed those of February, and in some cases ran ahead of the best early season records of last year.

Cole reports that February and March exceeded 1921 records by 50 per cent. March itself was far better than the same month last year, while its production and shipment figures exceeded those of February, 1922, by more than 100 per cent.

H. C. S. advises that January, February and March of this year doubled the records made last year, while April shipments apparently will be 100 per cent in excess of those of March.

Marmon's production and shipment figures for the early part of this year are double those of the 1921 period. March and April shipments are far ahead of the output for the same period last season. The present production monthly average is close to the maximum point reached last year, even when revised prices went into effect.

Stutz 20 Per Cent Ahead

Stutz's first quarter production and shipment were more than 20 per cent ahead of the same period last year. March, 1922, showed an increase of 50 per cent over February. April business is expected to keep up to March and probably pass it.

Lafayette's first buying spurt began at the New York show and the orders and consequent shipments have kept up. March business was better than the preceding months of this year. A higher schedule was put into effect thirty days ago.

Automotive Parts Co. reports that February and March business was up to the peak reached during the boom period. April will be the biggest month the concern has ever had, night shifts working at least three days a week.

Oakes Manufacturing Co. within the last three or four weeks has experienced a very sudden and large demand for its products. Production and shipment are now within one-third of the volume of boom times and far ahead of the same period last year. Nights shifts are also being operated.

Steady and Well Defined Flow in Buying Reached, With No Halt Apparent

By Charles D. Hastings

President of the Hupp Motor Car Corp.

Detroit, April 11.

UNLESS some unusual and totally unforeseen economic condition arises in 1922 there is no reason why the automotive industry and business generally in the United States should not continue to progress toward a happy point of prosperity.

There is nothing unusual about the present business in the automotive field except, perhaps, that a certain amount of it is deferred business which ordinarily would have developed in 1921 but for the lack of firmness in the business structure generally.

Business is now on a more stable footing. Deflations have been accomplished. Buying which started on a light and scattering scale in the fall of 1921 has been extended gradually until now it has reached a well defined and steady flow. There is nothing which would indicate that this flow of business will be interrupted.

In the automobile field price stability is a real factor in stimulating demand. The marginal buyer who has to anticipate market conditions is convinced that present prices represent ultimate declines and is buying. Then, too, the improvement in business tone has caused those who withheld buying cars against a protracted business slump to come into the market.

Because of its general appeal, the automobile market is the first to ride on an incoming business wave and the last to fall in a decline. The rise of business from the decline of 1920 is definitely under way. With the marketing of crops this fall the period of prosperity for all business should be well under way.

Midwest Engine Co. reports a light production during January, which increased at least 12 per cent during February and an equal amount during March. April will show more than a 20 per cent increase over last year. New contracts on which delivery will start in a little more than a month have been received together with orders from old customers who are now buying more engines than in previous months.

Robert H. Hassler, Inc., states that production and sales for the first quarter were about 25 per cent beyond figures for last year. Except for seasonal fluctuations, the annual output has risen steadily during the last three years.

Wheeler Schebler February and March production shows a gain of 100 per cent over November and December, and April will show a further gain of 25 per cent.

Burpee Johnson shipment and production figures for the first quarter are 100 per cent better than last year.

SHALER WORK RESUMED

WAUPUN, WIS., April 10—Production of Shaler vulcanizers, headlight lenses and other automotive equipment and appliances by the C. A. Shaler Co. has been resumed in temporary quarters pending the completion of the new plant which will replace the group destroyed by fire early in March with a loss of nearly \$300,000. Actual construction work on the new factory is already under way.

Durant Will Produce 200,000 Stars in 1923

Sample Cars To Be Turned Out
This Month—Sales Plan
Considered

NEW YORK, April 11—Durant Motors, Inc., has informed its stockholders that it has entered into contracts with the Star Motor Co. of New York, the Star Motor Co. of Michigan, and the Star Motor Co. of California to produce the Star car, which will sell at \$348, in the divisional plants of Durant Motors and under the same management. The production schedule of the Star for the calendar year 1923 has been tentatively fixed at 200,000. The production schedule for Durant fours and sixes for next year has been placed at 80,000.

Detailed plans as to the sales policy for the Star probably will not be announced for two months. It is proposed to turn out 100 sample cars this month, 500 in March and 1000 in June. After that production will be increased as rapidly as possible so that deliveries to purchasers can begin.

When the sales plan is evolved it probably will call for the establishment of divisional factory branches which will have direct charge of sales in territories
(Continued on page 842)

Parts Makers Feel April Improvement

Consensus Is That It Will Probably Exceed March Which Was Good Month

NEW YORK, April 10—Following are paraphrases of reports made by credit representatives of some of the leading parts manufacturers at a recent group meeting at which business conditions were discussed:

"Our March business was the biggest we have had—bigger than in any month in 1921. We feel that April is going to be a great deal larger than March. We sell to a lot of people in the South, and of late they seem to be coming through. Our collections indicate there is going to be a big improvement down there."

"We, too, are very optimistic about the future. March was a very good month and I believe April is going to be still better."

"March was very encouraging to us. Our April business already scheduled also is very encouraging. As a matter of fact March and April are going to be the best months we have had in a year and a half."

Sees April Biggest Month

"Our business for February and March was very good and we expect April to be the biggest month we ever have had. We can't get material fast enough for automobile manufacturers."

"Each month this year our shipments to automobile manufacturers have shown a material gain over the preceding month. The orders we have booked indicate that April will be at least equal to March and May will be good too."

"April is going to be a very good month. In fact it probably will be bigger than we can handle. We have had a night force in some departments to take care of April specifications."

"We feel very good about the prospects for April and May."

"Since the first of the year our production has increased steadily, month by month. April will be as good as March if not better. We believe this condition is general and that we can expect a continuance for at least 60 days after which we expect the usual lull."

"I have sounded our New York banks and they are very optimistic as to the future, much more so than they have been in a long time. Trucks are being moved and in places where we thought we had frozen loans we find we are getting substantial reductions. Another gratifying feature seems to be that dealers are not being overloaded beyond their capacity to sell."

Improvement Steady

"Our business has shown a steady improvement every month this year. We are now running three days a week whereas for several months we have been running only two days. We have some orders for delivery in April and May."

"Our outlook for April is that we will have a better month by far than we did in March."

"April orders from our principal customers are much higher than for March. It has been our experience that we cannot get anything like adequate notice on shipping requirements. They simply won't order until they have sold. They won't buy until they have sold. This is common to all branches of the industry. We won't tie ourselves up for

large quantities of material until we can see our way out."

"Our business is showing a steady improvement, nothing very startling but quite satisfactory nevertheless. The great trouble with our business is to keep a uniform manufacturing practice. We will get an order on a certain number of units today and tomorrow we may get a cancellation on a part of them. Automobile purchasing agents seem to be very much up in the air as to just what they will require and when they will require it. On the whole, however, we feel that we are going to have a very nice increase over the first six months of last year."

"We have been very much encouraged by our sales both to manufacturers and dealers."

"The automobile manufacturing end of our business was very good in March and April will be much better."

"The machine tool trade seems to be picking up. The truck industry also is improving and passenger cars are satisfactory."

Peerless Position Good Stockholders Are Told

CLEVELAND, April 10—In submitting to stockholders the annual report of the Peerless Truck & Motor Co., the following statement was made by President R. H. Collins:

Taking into consideration the general business depression, we feel that stockholders should be well satisfied with the showing and financial condition of the corporation. It will be the policy to continue to build and market one of the finest eight-cylinder cars, and the interest in our line, as reflected by actual sales since Jan. 1, is ample evidence of the excellence of our product and an indication that the country as a whole is gradually returning to normal conditions.

The recent declaration of the dividend for 1922 at the rate of \$3 per share, your president feels, is fully justified by present prospects and the excellent financial condition of the corporation.

Republic Truck Division Will Solicit Rail Trade

DETROIT, April 7—Republic Motor Truck Co., Inc., has organized a public utilities division under Ralph M. Sparks, to merchandise the Republic Knight-motored bus. This department will devote itself exclusively toward merchandising the bus to railway lines which have a problem of feeder service to meet.

Sparks is a well known passenger transportation man, having been connected for a number of years with a prominent railway line in the East. The efforts of this division will be fortified by the factory sales department and the distributor organization.

EMPLOYMENT IS GREATER

WASHINGTON, April 10—A survey by the Federal Employment Service of conditions in the automotive industry for March showed an increase in employment of 8.4 per cent over February, with the addition of approximately 15,000 to payrolls during the month by the companies reporting. The survey indicates that there will be greater activity in April. The employment service declared that industry as a whole took up considerable slack in March.

Business Is Taking Long Upward Swing

**Slow Progress in Milwaukee Encouraging to Manufacturers
—No Sharp Setbacks**

MILWAUKEE, April 10—A continuance of the progress made by the automotive industries in Milwaukee and vicinity during March, with respect to increased output, is reported in the first ten days of April. This is true as well of passenger car and motor truck factories as the makers of engines, frames, gears and other parts. The most favorable showing, however, is being made by the manufacturers of automotive equipment, who are getting good orders from the jobbing trade as the result of renewed buying interest among consumers being reflected into retailers' orders.

Although it would ordinarily be expected that slow progress makes a less satisfactory feeling than rapid advancement, representative men in the automotive industries locally are of the opinion that the gains now being established slowly furnish a most encouraging feature of the situation. Experience of the past year has shown that spurts are less substantial than the long upward swing, slow as it may be, they explain. The present trend has been unusual in that so far there have been no sharp setbacks, as before.

Local Trade Excellent

There is an extraordinary unanimity of opinion among distributors and dealers in this city relative to the comparative excellence of the state of retail business in this territory. Most dealers are able to say that they sold more passenger cars in March than in November, December, January and February put together. This March was a much better one for retail business than the corresponding month of 1921.

The improvement generally has been accentuated, in some instances rather sharply, in the past week. Better weather and more seasonable climatic conditions have contributed considerably to make this true.

On the other hand, the feeling is growing among owners that the bottom of the price decline not only has been reached, but may be subjected at any moment to a reversal. Consequently many of them are entering the market to take advantage of present prices on new cars and allowances being made on used vehicles. From 75 to 80 per cent of deals at this time involve trade-ins.

WHEEL MAKER BUYS PLANT

WOOSTER, OHIO, April 11—The Pneumatic Disk Wheel Co. of Richmond, Va., has purchased the Wooster plant of the Kelley-Springfield Tire Co., the consideration being \$150,000. The plant, which has been closed for some time, will be reopened July 1, and disk wheels for automobiles will be manufactured.

DuPont Expresses Confidence in 1922

Tells Stockholders That Year Had Auspicio is Opening for the Industry

NEW YORK, April 11—"The officers of General Motors Corp. believe that recovery from the depression of 1921 is reasonably assured and look forward with greatest confidence to a successful business in 1922."

This optimistic statement is the closing paragraph of a communication addressed to the stockholders by President Pierre S. duPont in submitting to them the final report of the corporation for the fiscal year ended Dec. 31. In his statement duPont says:

Industry Passes Test

Last year occasion was taken to call attention to the rapid growth of the automobile industry and to compare the volume of sales for the year 1920 with the annual sales of other important products. At that time the country was on the eve of a period of depression and liquidation, the extent of which was beyond accurate prediction. The importance and stability of the automobile industry during such periods had not been tested, therefore the outcome of business for the year 1921 was looked upon with confidence, doubt or apprehension, according to the viewpoint of the individual making the forecast. It must be conceded that the industry as a whole has withstood the test remarkably well.

In the first place, the increase of registrations of automotive vehicles from 9,211,295 in 1920 to about 10,488,000 in 1921 (an increase of 13 per cent) shows that the generally depressed conditions did not result in disuse of the automobile as a means of transportation. In fact, the number of cars in use actually increased in a period of rapidly declining values, unemployment and general business depression. Secondly, the value of automobiles produced, which stood at \$2,233,000,000 in the banner year of 1920, decreased in 1921 to an estimated \$1,222,000,000, or a decline of about 45 per cent. Thirdly, the number of cars and trucks produced fell from 2,205,000 to 1,680,000, or about 24 per cent. Fourthly, the domestic consumption of gasoline for 1921 as reported by the Bureau of Mines was 4,506,706,000 gallons, an increase of 6 per cent over 1920.

The above facts emphasize the importance of the automobile and establish the automotive industry as a permanently important factor in the country's development and activities.

Position in Market Satisfactory

General Motors Corporation has held its share of business with respect to the medium and high-grade cars. As a whole, its proportionate volume is slightly less, due to the fact that it is not as large a producer of low-priced cars as those of high and medium grade. The low-price field has naturally been the most active in depressed times; therefore, it is not surprising that General Motors Corporation shows a slight falling off from the average of the industry. However, its maintenance of position in the field is considered satisfactory.

Sales of passenger cars, commercial cars and tractors for the year 1921 totaled 214,799, compared with 387,190 in 1920; 406,158 in 1919; 246,834 in 1918, and 324,503 in 1917.

During the year 1921 it became apparent to the executive committee that the operations of certain divisions were in conflict with newly formulated plans for conducting the business of the corporation. Consequent changes and the reorganization of these divisions on the lines established have resulted in loss, not only in profits, but also through liquidation and scrapping of inventories and the abandonment of car, truck and tractor models not suited to the adopted rules for quality and performance. Some of these changes have been radical, but the executive committee has faced the reorganization without fear and in full confidence that the future would thoroughly justify the complete readjustment of unsatisfactory conditions.

Divisions Closely Knitted

It has been the effort of the officers of the corporation to knit more closely its different divisions in order that the greatest benefit might result from the co-operative conduct of this large business. Much is left to be done, but the foundation for closer co-operation has been laid and benefits are already accruing. Systematic study has been given to the relations of the several divisions to each other and duplication or conflict of effort has been avoided. As a whole, much has been accomplished and many plans laid that will develop to the future advantage of the corporation.

In the last annual report attention was called to the large accumulation of inventories toward the end of the year 1920 and the liquidation that had been accomplished on Jan. 1, 1921. This liquidation has gone steadily forward, so that inventories have been reduced from \$164,684,000 to \$108,762,000 (a reduction of \$55,922,000) during a period of comparatively small sales volume. This liquidation has been accompanied by reduction in payables as follows:

Current accounts payable have been reduced	\$9,702,000
Notes payable have been reduced	23,446,000

Total reduction in current indebtedness

\$33,148,000

The outstanding feature in the report of operations for the year 1921 is liquidation—liquidation forced by the sudden contraction of business to an abnormally low level throughout the United States, in face of declining values. The accomplishment of this liquidation in orderly manner is a tribute to American industry and the officers and employees of General Motors Corporation are to be commended for their effective work in the liquidating program. The corporation met the shock of abnormal retrenchment and stood it well.

The outlook is now brighter. The year 1922 opens with inventory accounts reduced to current basis and old commitments provided for or adjusted. The opening months of the year show substantial increase in demand and sales, not only with respect to corresponding months of 1921, when business was nearly at a standstill, but also as to several of our divisions even in comparison with the record year of 1920.

The officers of General Motors Corporation believe that recovery from the depression of 1921 is reasonably assured and look forward with greatest confidence to a successful business year in 1922.

MAIBOHM PLAN ADVANCES

TOLEDO, April 9—With only three more creditors to assent to the reorganization plan proposed for Maibohm Motors Co., Sandusky, it is believed the plan for Sandusky capital to take over the plant there will be approved in a few days.

Akron Tire Output Has Reached Normal

Factories, However, Are Not Running Full Blast—Goodyear Still Leads

AKRON, April 8—Tire production in Akron to-day is at the rate of 22,500,000 casings and 25,000,000 tubes a year.

Figures of the Rubber Association of America show slightly over 21,000,000 tires manufactured in the United States in 1921, Akron making more than 16,000,000 of that number. If this same proportion of tire production holds good for the entire year, based on Akron's estimated tire production, there will be close to 35,000,000 American tires built in 1922.

Daily Output 73,000

A census of Akron tire companies shows the following present production tickets: Goodyear, 22,000 a day; Firestone, 21,000; Goodrich, 14,000; Miller, 6000; General, 2000; Seiberling, 2000; all others, 8000.

The Seiberling production includes the local plant and the Lehigh plant at New Castle, Pa.

Figuring normal tire production in Akron at about 75 per cent of the peak of production of 1920, for there has not been a normal year in Akron upon which to base comparisons, then Akron's tire production to-day is normal. This does not mean, however, that the factories are running at full blast. Although Goodyear heads the list with 22,000 casings a day, Firestone becomes the virtual leader in proportion of peak output now being obtained, for whereas Goodyear's peak was 33,500 tires daily, Firestone's peak was 28,000.

All companies report heavier tube production. Goodrich is making between 18,000 and 19,000 tubes. Other companies show not quite so large a ratio of tube production, although it exceeds casing production.

Firestone has increased production 5000 tires a day within the past five weeks. Goodyear has increased from 18,000 tires at the beginning of the year.

General Doubles Production

General Tire is turning out twice as many tires as ever before in its history, and reports sales to-day more than 65 per cent greater than ever before. General will reach a basis of over 2000 tires daily by April 15. This will include daily production of 1000 special small sized tires.

The new Seiberling company is gaining production of Seiberling cords at the rate of 44 a day. Portage tire production at New Castle is approaching the thousand mark daily, while Seiberling cord production at Barberton exceeds 1000 a day. By June 1 the company expects to have a production of nearly 5000 tires daily. Orders are far in excess of production on Seiberling cords, it is reported.

Truck tire orders are getting heavier.

Stockholders to Act on Overland Plans

Meeting Called to Consider Bond Issue and Sale of Cer- tain Holdings

TOLEDO, April 9—The plans of the Willys-Overland Co., relative to the sale of its assets, which are represented by securities in affiliated companies and property not needed in the actual conduct of the business of the company, will be presented to preferred stockholders at a special meeting called for April 24, to be held at the Administration Building here.

The preferred stockholders at this time will also consider the approval of the plan to issue \$17,500,000 bonds or secured notes at 7 per cent to pay off bank loans which have been extended from time to time for more than a year.

The bonds would mature Dec. 1, 1923. Whenever stocks in affiliated companies and real estate pledged by the company under the terms of the bond security may be sold the proceeds are to be applied to reducing the outstanding bonds.

To Scale Down Plow Securities

In order to protect the interest of Willys-Overland in the Moline Plow Co., control of the common stock of which is held by the Overland, the preferred stockholders have been asked for written assent to a reorganization of the Moline Plow Co. by which its securities would be scaled down.

The Toledo directors of the Overland point out that this is the only hope for the Moline Plow Co. and the only way to keep it out of the courts. With the betterment in the agricultural machinery outlook and reorganization it is hoped to put the stock back to a basis where it may be sold. Consent of 75 per cent of the Willys-Overland preferred stockholders is necessary to permit the reorganization plan. Creditors of the company have agreed to the plan.

Notwithstanding the apparently poor showing in the annual report, most Toledo business men and bankers feel that Willys-Overland is in a very much better position to-day and that with the increase of sales and activity in the plant the losses of last year will be made up within a few years.

The plant here has been unable to get sufficient help the last week and has had to advertise in newspapers in all parts of the country for workers in the paint shop, woodworkers, body builders and trimmers. More than a dozen trades in these departments are short of men.

The annual stockholders' meeting has been announced for May 9, at the Administration Building. Election of directors will be the principal business of the meeting. Stock transfer books close April 27.

CURTIS R. HATHAWAY DIES

BOSTON, MASS., April 10 — Announcement is made of the death at

Pinehurst, N. C., of Curtis R. Hathaway, one of the organizers of the General Motors Corp. and of the Chevrolet Motor Co. He was sixty-three years old. Hathaway was born in Suffield, Conn. After his graduation from Amherst, he was a law student at Columbia University. He then became treasurer of General Motors, but retired in 1909 on account of ill health. Two years later, however, he became associated with Chevrolet.

Stark-Inland Assets Sold to New Company

ST. LOUIS, April 7—The Inland Products Co., a new corporation organized under the laws of Missouri and capitalized at \$500,000, has purchased the assets of the Stark-Inland Machine Works, manufacturer of piston rings and other automotive products.

Clyde C. Miner has been elected president and general manager. Under his management, it is expected that other products eventually will be added to the company's lines.

The company plans to erect a new factory which will be ready for occupancy within 90 days and will afford ample capacity to take care of the anticipated increase in production and sales.

Link Belt Sues G. M. C. Charging Broken Contract

WILMINGTON, DEL., April 10 — Claiming that the General Motors Corp. violated its contract, the Link Belt Co., an Illinois corporation, has brought an action in the United States District Court here asking damages of more than \$1,250,000.

It is charged that General Motors contracted with Link Belt for the manufacture of certain parts for the Samson tractor, but that before the contract was completed the design of the tractor was changed so that the special parts were no longer required. General Motors, therefore, it is stated, canceled the contract.

Link Belt claims to have erected special machinery to produce the parts.

OVERLAND MEETING CALLED

TOLEDO, April 10—A special meeting of the stockholders of the Willys-Overland Co. has been called for April 24 in this city, to take action on a proposal to issue \$17,500,000 in notes or bonds to mature not later than Dec. 1, 1923. Proceeds of the sale of new securities will be used to liquidate bank loans and provide new working capital.

TIRE RECEIVER REMAINS

ST. LOUIS, April 8—The motion of several stockholders, one creditor and the two receivers appointed by the Clayton Circuit Court for the Surety Tire & Rubber Co. for the removal of the receiver appointed in Federal bankruptcy proceedings, was overruled by United States District Judge Faris.

New Working Funds Provided National

Petition for Receivership With- drawn—Concern in Strong Position, Officials Say

INDIANAPOLIS, April 7—Coincident with the withdrawal of the receivership suit brought against the National Motor Car & Vehicle Corp., George M. Dickson, president, and M. E. Elstun, secretary-treasurer, announced the successful completion of the refinancing plans started some time ago by which the corporation receives more than \$450,000 of new working capital. This, together with the balance of the \$750,000 bond issue authorized by the stockholders, which has not yet been used in its entirety, places the concern in a strong position, according to the officials.

The officers say that the new capital, plus the balance of the bond issue which will become available at a later date, will enable the company to take advantage of the increased demand for its products which the revival in buying has brought. Increased factory production will go into effect at once.

Suit Was Misunderstanding

The suit for the appointment of a receiver instituted by an indemnity company on behalf of the claim of the Columbia Axle Co., was never heard in court. The action has been withdrawn on behalf of the plaintiff, which originally informed the indemnity concern, before the filing of the case, to delay action until plans then under way for the satisfaction of the claim were worked out. The day before the suit was filed a representative of the parts company had been in Indianapolis and reached what was considered a satisfactory settlement with the automobile company. Acting contrary to instructions that it is said had been given it, the indemnity concern started the action the next day.

The elimination of this suit and the new working capital the National now receives places the institution in a position to progress as it has done through a long period. National is one of the pioneers of the industry and exhibited in the first Madison Square Garden show.

Adria Reorganization Returns Old Officials

BATAVIA, N. Y., April 10—Another reorganization of the Adria Motor Car Corp. has been brought about under which Louis M. Vremsak again becomes president and Willard C. Wheeler, treasurer, displacing Timothy J. Dailey and his son, Harry. Alexander Gray of Ontario, who once was secretary of the corporation, also has returned to Batavia.

Most of the 600 stockholders in the company live in this vicinity. When the Daileys took charge of the plant, it was understood they were to pay the creditors and get the factory in operation.

Merger Will Include More Tool Companies

Manufacturers Aim for Stabilization—To Centralize Selling Organization

CLEVELAND, April 11—Merger of the larger machine tool manufacturers of the United States has been enlarged, since the first announcement of the project, to include the Colburn Machine Tool Co., Cleveland; Lodge & Shipley Machine Tool Co., Carlton Machine Tool Co., Newton Machine Tool Works, Betts Machine Co., Hilles & Jones Co., and the Dale Machinery Co.

"This is without doubt the largest merger of machinery manufacturing concerns that has ever been effected," said H. W. Breckenridge, vice-president and general manager of the Cleveland concern. He also said that the uniting of these organizations would effect a great stabilization of the machine tool industry of the country.

The selling organization of the corporation will be centralized with offices in New York.

"The new corporation will receive the advantage of keeping the present management of the plants instead of breaking in new men for the work," said Breckenridge. The present personnel of each plant will be retained.

The capitalization will be placed at \$35,000,000, all stockholders of the subsidiary companies turning in their stock and receiving in return its value in stock of the larger corporation.

F. Handley Page States German "Gotha" Was Copy

LONDON, March 31 (By Mail)—The Handley Page Co. has a claim before the Commissioners on Inventors' Awards concerning the "O" and "V" type of biplane as made by others during the war, by direction of the war-time authorities.

F. Handley Page, managing director of the company, testified in connection with the claim that the German "Gotha" was a copy of his machine and until the Germans captured a Handley Page, all complete, and were able to fly with it, they were not conversant with the structural details or convinced of the aerial dynamics in regard to big machines.

Two Directors Added to Kelly Truck Board

SPRINGFIELD, OHIO, April 11—R. J. Westcott, president of the Westcott Motor Car Co. and treasurer of the American Seeding Machine Co., has been elected a director of the Kelly-Springfield Motor Truck Co. to succeed J. B. Cartmell, who resigned owing to increased business in banking circles. Westcott is also a director of the Citizens' National Bank and was formerly mayor of Springfield. Alfred G. Hare, senior member of Hare & Chase, Phila-

delphia, succeeds Emlen F. Hare as a director.

James M. McCarthy of Quebec, capitalist and engineer, has been elected vice-president, the anticipation being that the election will result in a closer affiliation with Canadian business men.

Charles M. Young, president of the company, was present at the meeting of the board when the elections took place, as was James L. Geddes, chairman of the board, who is recovering from a long illness.

An excellent outlook is reported at the factory, the company having enjoyed the largest business last month than at any time for more than a year. The force is being augmented by the addition of skilled workmen.

Trustee Handles Parenti for Creditors' Benefit

BUFFALO, April 10—The affairs of the Parenti Motor Corp. have been placed in the hands of the Marine Trust Co. as trustee, for the benefit of creditors. The corporation has 11,000 stockholders here and in near-by cities.

Albert M. Saperston, representing the trust company, said it had not been decided whether the business would be continued or liquidated. Liabilities, he said, were approximately \$200,000 and assets \$400,000. The assets include a new factory and considerable raw material, but there is no cash in the treasury.

"The statement of the company shows it to be absolutely without funds," says a statement issued by the trust company.

The Parenti company was organized three years ago. An extensive stock-selling campaign marked the first two years of its existence. About 100 cars have been made, chiefly for demonstration purposes in connection with stock sales.

Buell Will Liquidate Assets of Sandow Truck

CHICAGO, April 8—Under an agreement with creditors, Edward D. Buell has been appointed as trustee to liquidate the assets of the Sandow Motor Truck Co. Buell estimates that the total liabilities, including \$164,000 indebtedness to banks, will amount to \$207,000.

The bank creditors have agreed to wait until the general creditors have received 50 cents on the dollar before they participate in the proceeds of any of the assets, except those pledged to secure bank loans. The physical assets of the plant will be sold at auction April 14. The trustee expects that all creditors, including the banks, will realize about 50 cents on the dollar.

RUBBER, CHINA CLAY FOR ROADS

LONDON, March 28 (by mail)—Experiments have been made testing the value of a compound of rubber and china clay for road surfaces. The tests promise well and, pending final trials, several rubber companies are considering the advisability of erecting plants to supply the material.

G.M.C. Acquires New Factory in England

Business Growth Leads to Occupancy of Grahame-White Plant in London

LONDON, March 31 (by mail)—The intentions of General Motors, Ltd., the English subsidiary of General Motors Corp., to consolidate assembly here, have culminated in the acquisition of the Grahame-White aircraft factory at Hendon, London, N. W. All G. M. C. passenger cars are now being imported from Canada in partially disassembled condition are to be finally assembled, tested and distributed from the Hendon plant, except Cadillac cars and G. M. C. trucks, which are still imported from the United States.

The company's new plant has approximately 35,000 sq. ft. of floor space, with three assembly lines already organized and two more contemplated. Spare parts to the value of more than \$500,000 have been transferred from the Thurlow Street property previously occupied.

The company's decision as to the price of its assembled cars, notably the Chevrolet which at \$260 is the only serious competitor here with the Ford, will be awaited with great interest, the more so as many dealers are perplexed over the Ford company's recent action regarding price reductions with no allowances to dealers on cars in stock and acquired at the old price.

Trade Exceeds Expectations

NEW YORK, April 10—In confirming the acquisition of the Grahame-White plant, officials of General Motors here declared that their present business in the British Isles was much in excess of what had been expected only a few months ago. Actual shipments to England made in March from the Canadian plant totaled more than 1000 cars, this showing a very large gain over the previous month.

Attention was called by the officials to the fact that the plant will not be used for complete assembly, in the same sense as this describes the Ford operations at Manchester. Completed cars or chassis will continue to be shipped from the Canadian plant and these will be uncrated, reassembled and made ready for operation at Hendon. Chassis, in some cases, will be fitted with special bodies made in England or to suit local needs. The plant will supply only the British Isles.

The cars being shipped from Canada are the Chevrolet, Buick, Oakland and Oldsmobile. This is in line with the recent decision of the corporation to supply export orders on these lines to practically all parts of the world from Oshawa.

The announcement was made that A. N. Lawrence, director of sales of the English company, is now visiting the United States to look over General Motors plants.

Ford Car and Truck Have Many Changes

New Type of Headlamp Is Important Feature—Mechanical Alterations Are Made

DETROIT, April 8—A number of detailed mechanical changes and refinements have been made recently on both Ford cars and trucks. The most important is the use of a new Type H headlamp for both cars and trucks, and for replacement on cars already in use. The lamp is equipped with a special design refracting type lens and a new 21 candle-power gas filled double filament bulb. The new lamps when properly adjusted are legal in all states, although there is great increase in road illumination.

Interior Finish Changed

The closed models are now being finished in walnut brown broadcloth, the seats being upholstered in the same material with a chalked ebony stripe. Heavy floor rugs are provided, and special design lifts have reduced the effort necessary in raising the windows. Door bumpers insure tighter fitting, and new door grips inside and out add to the convenience.

Mechanical changes are as follows:

The pistons and connecting rods have been redesigned and matched for weight before assembling to reduce vibration and give quicker pick-up. The new pistons are $\frac{1}{4}$ lb. lighter than the old.

The crankshaft surfaces are highly polished to reduce wear and make for smoother running.

A new carburetor gives increased acceleration with quicker pick-up and greater flexibility.

The wiring system has been completely redesigned, and all wiring is in loom where necessary to comply with underwriters' insurance rules.

Steering Wheel Additions

A 16-in. steering wheel is now regularly fitted and a steering wheel stop limits the travel of the steering wheel between the positions in which the front wheel spindles strike the front axle yokes. The full steering wheel motion is always effective in turning the front wheels, and the stop prevents straining or buckling the steering mechanism after the front wheels have reached the limit of their travel. Improvement has been made in the steering mechanism itself by the use of a taper construction on the steering ball bolt. The tapered bolt fitting into a special tapered seat in the steering connecting rod yoke provides a construction initially tight and prevents looseness and rattling in service.

Timken roller bearings are now used on models with demountable rims.

The radiator is now spring mounted and the fastening of the front radius rods has been improved by the use of tapered nuts in tapered seats.

The crankcase front end bearing has been redesigned, making it simpler and at the same time providing greater flexibility for the front spring. The new spring hangers are in one piece to maintain permanent alignment.

A new design cut-out is mounted directly on the generator.

The running-board brackets are of one piece, pressed steel, and make for body rigidity.

A dash weather trough prevents rain from reaching the coil terminals or the dash wiring.

Cord tires have been adopted as standard equipment on the rear wheels of the truck chassis.

A new spare tire carrier combines light weight with increased strength and rigidity.

In the equipment is to be noted a new license plate carrier, which will fit the tags of all states, a new jack and a new tire pump.

Essex Improves Design in New Phaeton Model

DETROIT, April 10—Several improvements have been made in the design of the Essex phaeton. The body is entirely new, being longer and wider. Body doors are wider and are hinged at the front. They now have inside as well as outside door handles, and the front pockets are enlarged to accommodate the improved storm curtains. The price is \$1,095.

A new windshield, with a more handily operated top glass and forged side supports, is used. The shield and tops are both lowered. The head room remains unchanged, however, because the cushions are lowered and the general seating position is modified. A nickel robe rail is provided in the tonneau. Fenders of a new style, fully crowned and harmonizing with the general lines, are used.

Chassis changes include the adaption of a round gasoline tank, new type gasoline gage and carriers for a single tire. All new cars are equipped with the new type chassis oilers that replace the former grease cups.

NEW CLYDESDALE TRUCK

CLYDE, OHIO, April 8—The Clydesdale Motor Truck Co. is bringing out an all-steel truck which has a total capacity of 6850 lb., including the weight of the chassis, which is 3100 lb. This gives a carrying capacity of body and load of 3850 lb. The price is \$1,485, which includes the starting and lighting system.

RAILWAY ASKS FOR BIDS

CHICAGO, April 10—The Southern Pacific Railway Co. has asked for bids on the construction of 2000 single sheathed steel super-structure automobile cars of 50 tons capacity to be used on its system. These cars, which will be of the most modern type, will be equipped with double swing end doors and staggered side doors. The order is the largest ever placed by a Western road for this class of equipment.

Re-organization Plan for Earl Is Accepted

Lines of Credit Arranged—Company Has Orders on Hand for 2,500 Cars

DETROIT, April 12—Earl Motors, Inc., will begin a production schedule of 50 cars daily following the completion of its financial program, declared operative by banking interests this week in Chicago. The company declares it has orders on hand for 2500, to meet which it will employ a night shift starting immediately. Under the readjustment there is practically no current indebtedness. Sufficient funds are provided to permit capacity operation.

All important creditors of Earl Motors which became involved in the difficulties of the Fort Dearborn banks in Chicago have assented to the reorganization plan and have assigned their claims to the committee. Lines of credit have been arranged with Chicago, New York and Jackson banks.

Clarence A. Earl will continue as president of the company, devoting particular attention to the development of the sales organization.

George C. Scobie, recently with the Hayes Wheel Co. and formerly with Price, Waterhouse & Co., has been elected vice-president and comptroller and will have charge of the company's financial affairs. Other officers are Walter Mery, vice-president, and L. S. Westcoat, treasurer.

The banking interests and manufacturing creditors are largely represented among the new board of directors which has been elected. A sufficient amount of common and preferred stock has been pledged for deposit in a voting trust to assure the continuance of a directorate which is made up as follows:

Rumsey W. Scott, vice-president of the Chemical National Bank, New York; John O'Leary, vice-president of the Chicago Title & Trust Co.; J. E. Farrell, vice-president and treasurer of the Sinclair Refining Co., New York; William Sparks, president of the Sparks Withington Co., Jackson; Frank Joyce, vice-president of the American Auto Trimming Co., Detroit; Earl, Scobie and Westcoat.

Chassis of Overland 4 Redesigned for Trucks

TOLEDO, April 10—An Overland Four chassis, redesigned for truck use, has been brought out by the Willys-Overland Co. and will sell for \$450 f.o.b. Toledo.

The truck chassis differs from the passenger car chassis in that it has heavier axles, stronger rear springs and a round gasoline tank mounted directly above the dash. The tank has been placed in this position to permit use of standardized types of truck bodies designed by various manufacturers for 100-in. wheelbase chassis.

Lincoln Motors Case Rouses Congressman

Impeachment Threatened Attorney General—Claim Results from War Contracts

WASHINGTON, April 11—Threatening the impeachment of Attorney General Daugherty for his "failure to prosecute the case of the Government against the Lincoln Motor Company," Congressman Roy O. Woodruff, of Bay City, Mich., Republican, to-day made a sharp attack upon the War Department, Department of Justice and former Attorney General A. Mitchell Palmer.

The Attorney General's failure to investigate contracts made with the War Department, Woodruff charged, has resulted in defrauding the Government out of millions of dollars. He said:

Charges Big Overpayment

The Lincoln Motor Company during the war received large contracts for the air service, and has been shown by the Government audit to have been overpaid to the extent of \$9,188,561.90.

This concern some time ago was thrown into the hands of a receiver. The receiver has sold this property to Henry Ford for \$8,000,000 cash which the receiver now holds.

This case had been turned over to the Department of Justice and by it referred to the District Attorney at Detroit for necessary action and suit had been started in the United States District Court against the receivers of the Lincoln Motor Company.

"We find the policy pursued in the past in some other cases, now being pursued by the Department of Justice in the case of the Lincoln Motor Company," Woodruff said, declaring that the case of the Lincoln company "has been taken out of the hands of the District Attorney at Detroit and has been returned to the Department here."

A new hearing is to be granted the Lincoln Motor Company, which will begin here to-morrow, and the speaker declared that unless the Attorney General "attended the hearing and represented the Government in the prosecution of the case," he would seek his impeachment for misfeasance of office.

The speech of Woodruff came in the nature of an appeal for support of a resolution which he introduced, preceding his speech, asking for the appointment of a select committee of Congress to investigate the Lincoln Motor contracts and all other contracts and expenditures made by the War Department, Navy Department, Alien Property Custodian and their departments during the war.

Involves Weeks in Bosch Sale

Woodruff also charged, in effect, that Secretary of War Weeks had been involved in the sale of the Bosch Magneto Co. and that Martin E. Kern, the original purchaser, had advised his agent to "take Weeks to Daugherty and put a quietus on this thing," meaning the proposed prosecution of the Department of

ARABIC DEPICTS CAR

TOLEDO, April 10—What is said to be the first automobile instruction book to be printed in Arabic has been received by the Willys-Overland Co. at Toledo, from its dealer, Mr. Loukaitis at Cairo, Egypt. The book is illustrated with views of the engine and chassis and charts of the various mechanical operations that go to make up an automobile.

Justice to set aside the sale of the German concern.

It was asserted by Weeks that the firm of Hornblower & Weeks, of which Secretary of War Weeks formerly was a member, has sold the bonds and figured in the rehabilitation of the American Bosch Magneto Corp. with a profit of \$1,000,000 on the transaction.

Woodruff continued to say:

On December 31, 1918, nearly two months after the armistice, the capital stock of the Bosch Magneto Company was sold by the Allen Property Custodian to one Martin E. Kern for \$4,150,000.

Kern was a close personal friend and client of Palmer, Allen Property Custodian at the time of the sale. It appears that Kern was not an American citizen, but was apparently of German birth and citizenship. It would also seem that he had served three terms in prison in the State of New York for felonies committed by him, and I hold here in my hand copies of his photograph appearing in the Rogues' Gallery in New York City. Apart from the fact, which seems to be admitted that Kern was not an American citizen, his conviction of a felony would deprive him of his civil rights and it does not appear that through pardon or other executive clemency such rights have ever been restored.

The trading with the enemy act, under the provisions of which the property was seized and subsequently sold, prohibits the sale of property to other than American citizens.

Following the introduction of Woodruff's resolution, it was referred to the Special Committee on Rules, who is expected to make an early report on it. Chances of the resolution being adopted and the appointment of a special committee to investigate all war-time contracts are reported favorable.

Daugherty Will Investigate

WASHINGTON, April 13—It was announced to-day at the Department of Justice that Attorney General Daugherty will personally investigate the war contracts of the Lincoln Motor Co. He will return here Friday and has ordered that the inquiry be postponed until 3 p.m. that afternoon so he can preside.

Before leaving Washington Sunday night, Daugherty made arrangements for a full hearing on the Lincoln contract before a court composed of Assistant Attorney General Goff and two assistants with attorneys for the receiver of the motor company. It has been planned that all interested parties shall be given opportunity to present their arguments.

Senate Bill Retains Duties House Levied

Increases Taxable Automotive Products—Places Imports on Foreign Valuation Basis

WASHINGTON, April 11—The 25 per centum ad valorem duty, as carried in the House bill, has been approved by the Senate Finance Committee, in its report to the Senate on automobiles, automobile bodies, automobile chassis, motorcycles and parts of the foregoing, whether finished or unfinished. The committee revised the House paragraph by adding motorcycles and including "finished and unfinished automotive products." Furthermore, it struck out the clause in the House bill which would assess an additional duty on countries where customs discriminated against American automotive manufacturers.

The 30 per cent ad valorem rate on airplanes, hydroplanes, motor boats and parts in the House bill was retained by the committee.

Flexible Tariff Provided

The fact that the Senate bill places ad valorem duty on a foreign valuation basis as contrasted with the American valuation basis carried in the House bill, makes the bill a far different measure than when it came from the House, and it may be expected that this feature will be the object of a vigorous contest between the House and the Senate before the measure finally is enacted into law. There are clauses connected with the Senate bill, however, which call for flexible tariffs or a different basis of assessing duties, and these may lessen the differences between the two branches of Congress. In many instances the Senate bill, being based on a foreign valuation basis, carries higher ad valorem duties than the House bill. The increases are estimated from 30 to 50 per cent.

Financing Association Reduces Its Annual Dues

NEW YORK, April 10—The Automobile Financing Creditmen's Association has decided to reduce its dues to \$10 a month with an additional charge of three cents for each serial number card filed. These cards contain the serial number of automobiles financed, and when the card is filed with the association the first step taken is to determine whether any other member of the association has financed the same car. If this is found to be the case, both companies are notified immediately. The maximum charge against any member for membership is limited to \$500 a year.

It also has been decided that where finance companies at a distance of more than 150 miles from New York form a local organization, the New York association will permit the local, if consisting of six or more members, to join it as a single member with all membership privileges except the right to vote.

Men of the Industry and What They Are Doing

Resigns Schrader Presidency

M. Charles Schweinert has resigned as president of A. Schrader's Sons, Inc., of Brooklyn, after a service of more than 35 years with the company as general manager, treasurer, director and president. Because of his wide knowledge of the business and his engineering skill, he has been retained by the corporation in an advisory capacity. Henry P. Kraft, vice-president and treasurer, who has been associated with the Schrader company for the past 39 years, will succeed Schweinert as president. The Schrader company has been in business since 1844 and in recent years has become a large manufacturer of automobile accessories. Schweinert will devote much of his time to looking after his personal interests.

Cole Returns From Europe

J. J. Cole, president of the Cole Motor Car Co. of Indianapolis, has returned from an extended pleasure trip to Europe where he visited most of the large cities. He says that American built cars are seen everywhere in Europe and he believes that talk about the superiority of European built cars is unfounded except as it relates to the care and hand work put on custom built bodies.

Sutherland With L. F. Benton Co.

R. W. Sutherland, former general manager of the Splittorf Electric Co., has been elected vice-president of the L. F. Benton Co., which manufactures screw machine products at Vergennes, Vt. Sutherland retired from the Splittorf company about six months ago after a service covering several years. He first represented the company on the Pacific coast, then in Europe during the war and later was in charge of its branches. When C. W. Curtiss resigned as general manager of the Splittorf company, Sutherland was elected to succeed him.

Vincent Bendix Is Married

Announcement is made of the marriage of Vincent Bendix, inventor of the Bendix drive and director of the Parrett Tractor Co., to Mrs. Elizabeth Ashton at the home of the bride's parents, Mr. and Mrs. James Harrison Shannon in Chicago. Mr. and Mrs. Bendix will live in East Walton Place, Chicago.

Kraus Appointed Export Manager

H. L. Kraus has been appointed export manager for the Milwaukee Motor Products, Inc., Milwaukee, Wis., manufacturer of timers. Offices have been opened at 130 West Forty-second Street, New York.

C. W. Matheson Promoted

C. W. Matheson, who has been general sales manager of Dodge Brothers Motor Car Co. since 1920 has been promoted to vice-president in charge of

sales. John A. Nichols, Jr., director of field operations, becomes general sales manager and John H. Gordon, director of distribution.

Smith on N. A. C. C. Committee

Frank E. Smith, president of the Republic Motor Truck Co., has been added to the membership committee of the motor truck committee of the National Automobile Chamber of Commerce.

Farrington Heads Branch

W. H. Farrington has been elected president and general manager of the Maxwell-Chalmers Sales Co., the Chicago factory branch of the Maxwell-Chalmers Corp. He succeeds J. H. Willson who goes to Dodge Brothers to have charge of the foreign sales. Willson formerly was in charge of foreign sales for General Motors Corp. Farrington has been with the Maxwell-Chalmers Sales Co. for five years and has been in the automobile business in Chicago for 16 years.

Sharon Adds Representatives

Two additional sales representatives have been appointed by the Sharon Pressed Steel Co. They are W. C. Aines, who will have his offices at 20 East Jackson Boulevard, Chicago, and Ralph E. Philips, whose headquarters will be at 66 Broadway, New York City.

Heffley at New York Office

C. C. Heffley has been appointed manager of the New York office of the Bethlehem Spark Plug Co., Bethlehem, Pa. In conjunction with looking after the general sales in that territory he will handle all export business for the company.

David Goes to St. Louis

J. W. David, for the past five years connected with the Philadelphia branch of the General Motors Truck Corp., has been appointed manager of the St. Louis branch to succeed C. E. Pagett, who has taken over the sales management for the De Luxe Auto Co., Oldsmobile distributor in St. Louis.

Flyum Succeeds Keller

G. M. Flyum, former manager of the Brooklyn branch of the Bearings Service Co., has succeeded N. B. Keller as manager of the Minneapolis branch. W. H. Richardson, former New York branch manager, has been named assistant sales manager and assigned to the Eastern district with headquarters at Detroit.

BOSCH DOUBLES FORCE

SPRINGFIELD, MASS., April 11—The American Bosch Magneto Corp. is employing twice as many workers as it did this time a year ago and is operating at about 50 per cent of capacity.

Highway Educational Committee Appointed

Plans Formulated for Propaganda Work—Conference Will Be Held in October

WASHINGTON, April 11—The appointment of the educational committee of the Highway and Highway Transport Committee, which met here on April 7, was announced to-day by the National Automobile Chamber of Commerce. The personnel is as follows: T. H. McDonald, chief of the Bureau of Public Roads; Roy D. Chapin, chairman of the Highways Committee of the N. A. C. C.; Dean F. L. Bishop, University of Pittsburgh; Col. W. Boggs of the War Department; Pyke Johnson, Washington representative of the N. A. C. C., and Dr. Walter C. John, acting director of committee.

Plans were formulated by the committee for the dissemination of educational propaganda for highway transport through the education of pupils in the fifth and sixth grades of the public schools, of which there are 16,000,000, according to a recent census.

The educational committee met with the two national program committees to outline programs for highway engineering and highway transport sections of the proposed second national conference on the educational aspects of highway transport.

The latter part of October was selected as the tentative time for the conference, to be held in Washington. It was proposed that the conference should last three days.

Electric Service Body Increases Membership

DETROIT, April 7—The Automotive Electric Service Association, comprising companies representing national manufacturers of electric equipment for cars, reports the addition of about twenty members since its annual meeting during the Chicago show, and is continuing vigorously its campaign for further enrollment.

Under its constitution, the association has been unable to entertain the proposal of the National Automotive Electrical Association to take over the entire membership of this organization, but has notified it that it will accept for membership all companies representing manufacturers affiliated with the Automotive Electric Association.

Sectional meetings of the association are planned as soon as the membership has been increased to a satisfactory point. A series of bulletins are now under way which will keep members and prospective members in touch with its activities.

Cooperation, Theme of Hoover Meeting

Conference at Washington Considers Possibilities of Trade Associations' Efforts

WASHINGTON, April 12—The automotive industry is well represented at the conference with Secretary Hoover today of representatives from trade associations in all lines of activity. The conference has been called to learn what trade statistics and data the Department of Commerce can hope to receive from trade associations and how best to disseminate this information when it is compiled.

While no place has been given on the program to a discussion of the rights of trade associations to gather trade statistics in view of the recent decision of the United States Supreme Court in the hardwood lumber case, it is not improbable that this highly important subject will be touched upon. The views of Secretary Hoover do not coincide entirely with those of Attorney General Daugherty on this question.

The National Automobile Chamber of Commerce is represented by J. Walter Drake, chairman of the foreign trade committee, and General Manager Alfred Reeves. The representatives of the Motor and Accessory Manufacturers Association include W. O. Rutherford, one of the vice-presidents; Sidney S. Myers, general counsel, and M. L. Heminway, general manager. The Rubber Association of America is represented by A. L. Viles, its general manager.

Lee to Hold Conference

All the associations within the industry which are interested in export trade will be represented at the conference called for to-morrow by Gordon Lee, chief of the automotive division of the Bureau of Foreign and Domestic Commerce. The purpose of the meeting is to discuss how best to co-operate in promoting the sale of American made automotive equipment in foreign fields. The meeting will be attended by the chairmen of the various export committees and the foreign trade secretaries of the various associations which have export divisions.

Reeves had conferences yesterday with W. P. G. Harding, Governor of the Federal Reserve Board; Secretary Hoover and one or two other Cabinet officers as well as with the trade associations committee of the United States Chamber of Commerce. Last night he attended a meeting of the American Association of Trade Executives to prepare for the Hoover meeting to-day.

Survey of Activities Made

WASHINGTON, April 12—The National Association of Manufacturers has completed a survey of trade associations and their activities, based on a questionnaire sent out some time ago. The great number of replies discloses that the associations are not only willing but anx-

ious to make public their activities, and for the most part are also desirous of co-operating with the Government as well as with their own respective industries.

The associations which replied to the questionnaire represent on the average 64.9 per cent of the business of the country in their particular lines. Most of the associations declare that the primary course is to improve and extend acquaintance among the members in a certain industry. The elaboration of purpose is mainly toward the nationalization of trade association methods and aims.

The National Automobile Chamber of Commerce reported it did not collect statistics on costs, prices, consumption or distribution, but confined its activities to statistics on production of complete motor cars and motor trucks, which are published at intervals and annually. The reply of the organization to the questionnaire was that they give freely of their services whenever information is desired on matters relating to the automotive industry.

As to the handling of legislative questions and litigation, both national and state, the N. A. C. C. pointed out that it opposed continuation of discriminatory Federal excise taxes on motor cars and trucks and parts; favored reduction in tariff on automobiles imported; supported modifications in highway act designed to concentrate Federal funds on most heavily traveled highways, thereby reducing waste; supported movement for uniform state laws governing the use of motor vehicles.

Reports from the Motor and Accessory Manufacturers Association showed that it has no statistical department and its educational activities are largely those common to other trade associations. They declared that legislative problems are undertaken with other associations in the automotive industry through the channel of the Motor Vehicle Conference Committee.

Draw Bar Work Shows Tractor More Valuable

WASHINGTON, April 12—Analysis of the preliminary report of the survey made by the Department of Agriculture on the relative value of tractors on the farm as compared with horse power for draw-bar work shows that of the 354 farm owners reporting, 75 per cent found the tractor more profitable.

The cost of tractor operation in this work, the land averaging 500 acres, was \$484 for the year, or \$1.60 a working hour. These farmers also kept an average of 8.3 head of workstock, the cost of which for the year was \$541.

Based on a total of \$1,025 for draw-bar power, figures show that the tractors furnished more than half the power for 40 per cent of the cost of the entire draw-bar work.

There were great variations in the practices and costs on individual farms, and the results indicate that often the expense of using the tractors and keeping the workstock was excessive for the amount of work done.

U. S. Registration Bill Is Submitted

Revenue from Anti-Theft Act Would Be Used to Build Post Roads

WASHINGTON, April 12—Federal registration of motor vehicles would be mandatory under a bill introduced in the House by Representative Mills of New York. The measure, which has been referred to the Committee on Ways and Means, would provide for a \$2 tax which would provide revenue for the construction of post roads as provided in the Federal Aid act of 1916. Ostensibly the main purpose of the measure is to curb automobile thefts by providing a permanent number for every car, and make it necessary to file with clerks of the United States court bills of sale for every motor vehicle sold.

Motor Vehicle Defined

The Mills bill defines the term "motor vehicles" as vehicles propelled by any power other than muscular, except motorcycles, traction engines, road rollers and such vehicles as run only upon rails or tracks. It stipulates that applications which must be filed to obtain registration blanks shall give the following information:

(a) A brief description of the motor vehicle to be registered, including the name of the manufacturer and factory number of such vehicle, the character and amount of the motive power stated in figures of horsepower in accordance with the rating established by the Association of Licensed Automobile Manufacturers.

(b) Whether the engine or body or any other substantial part of such motor vehicle ever constituted a part of a former motor vehicle registered hereunder; if so, then a statement of such prior registration number and the cause of the dismantling of such former motor vehicle.

(c) The name, age, residence and business address of the owner of such motor vehicle. Such application and statement shall be acknowledged and sworn to by the applicant before a notary public or other officer authorized to the acknowledgments to deeds and shall be filed with said clerk within four months after this act takes effect for all motor vehicles then in use on said post roads. Then and thereafter every such motor vehicle must be registered hereunder before the same may be sold and delivered by the manufacturer thereof or used on said post roads. Failure to comply with any of the provisions of this section shall constitute a misdemeanor punishable by a fine not exceeding \$1,000 or by imprisonment.

Number to Be Given

The bill provides further that any motor vehicle driven upon the post roads of the United States upon which the tax has not been paid and which has not been registered as required by this act shall be subject to forfeiture to the United States. It is also provided that the clerk of the Federal Court shall assign to such motor vehicle a distinctive number which must be marked on the engine and outside body.

New York Territory Gained in Quarter

**This Year 11,792 Passenger Cars
Were Registered—Last Year
Total Was 6,330**

NEW YORK, April 10—New passenger cars registered in the first three months of 1922 in ten counties in and around New York numbered 11,792, as compared with 6330 in the same period last year. March registrations also showed a gain of almost three to one over January and February, respectively.

Ten cars in the medium and low priced classes have registered more than 200 each since Jan. 1, four of these having more than 1000, one almost 1000 and the remaining five running from 225 up to almost 300. In the high priced class seven cars have registers of more than 40 for the three months.

A summary of registrations for the ten counties, taken from the monthly report of Sherlock & Arnold, publishers of the Automobile Sales Analysis, is as follows:

Cars below \$2,500		
	1922	1921
January	2,019	483
February	2,231	1,409
March	6,354	3,396
Total	10,604	5,288

Cars \$2,500 and above		
	1922	1921
January	283	145
February	273	210
March	632	487
Total	1,188	842

Durant Will Produce 200,000 Stars in 1923

(Continued from page 833)

which will include several states. These factory branches will appoint distributors and they in turn will appoint dealers. Each distributor will be required to name a large number of dealers who will agree to provide parts and service for the Star.

W. C. Durant has not yet decided definitely whether or not he will acquire the Elizabeth factory of the Willys Corp. for use as an assembling plant for the Star. Negotiations still are pending.

Awards Frame Contract

NEW YORK, April 13—Durant Motors, Inc., announces that the frame contract for the new Star car has been awarded to the Parish & Bingham Corp. of Cleveland.

800 Cars at Muncie for April

MUNCIE, IND., April 11—The tentative schedule for April for Durant Motors, Inc., at its plant here calls for the manufacture of 800 cars and it is the hope of the company to complete 5000 cars by August, the end of the company's fiscal year.

During March more than 500 Durant sixes were produced and shipped to points

On the Up Grade

PHILADELPHIA, April 8—L. H. Gilmer, manufacturer of woven products, reports that total sales for February exceeded those for any month for a year and a half. March business showed an increase over February of more than \$30,000, and on a tonnage basis the shipments exceeded any month in the company's history.

CHICAGO, April 10 — The Stewart-Warner Speedometer Corp. reports that its sales for March were the largest of any single month since June, 1920. The increase over March of last year was 140 per cent. The first quarter of 1922 showed 110 per cent increase over the corresponding period of last year. Orders received for April shipment indicate that sales this month will be greater than in any April in the company's history.

STOUGHTON, WIS., April 10—New orders for trucks for a wide variety of purposes, principally passenger buses, farm dairy and milk hauling vehicles and the lighter types of delivery cars for merchants, have made it necessary for the Stoughton Wagon Co. to increase its working force and also extend the schedules of its motor truck division.

DETROIT, April 8 — During March the Packard Motor Car Co. received more orders for both twin sixes and single sixes than could be shipped. Men on the payroll number 4700, and some departments are working nights. Truck sales continue to expand.

SYRACUSE, April 8—Franklin Automobile Co. shipments for the week ending April 1 exceeded shipments for the entire month of February. Shipments during the week were the largest for any week during the last nine months.

NEW YORK, April 10—The Metal Stamping Co., manufacturers of Lion bumpers, reports that March was the biggest month in its history. The output of bumpers exceeded 34,000.

in the United States and Canada. There are now 460 persons on the payroll, which is an increase of 110 over March 1.

BUSINESS BEST IN TWO YEARS

PHILADELPHIA, April 11—According to David Ludlum, president of the Autocar Co., business is better now than at any time in the last two years. The crisis in business is now regarded as passed, and the future is particularly encouraging.

Used Car Situation Has Brighter Tinge

**Dealer Responses to Paige Questionnaire Indicate Demand
Is Strengthening**

DETROIT, April 7—Responses received by the Paige-Detroit Motor Car Co. to a questionnaire sent out to leading distributors are taken by the factory to indicate a gradual increase in the used car demand and a very definite strengthening of dealer confidence in the ability to overcome the used car situation.

Continued stagnation in used car stocks is ascribed by the factory only to those dealers who have been unwilling to write off the differences between original allowances on cars and present market values. Where the dealer has reduced his prices to make them conform to newly created values he has had little difficulty in bringing his stock down.

Paige finds a practice growing among its dealers of taking in cars at allowance which permits them to make a quick resale at a small profit. Though there is a great deal of competition for sales still, the questionnaires would indicate a great deal of conservatism in allowances made by dealers on the exchanged cars.

April Brings Chicago Best Week This Year

CHICAGO, April 7—A decided pick-up in the retail sales of automobiles in Chicago is indicated by the time-payment sales for the week ending April 1 in which 1003 chattel mortgages to secure deferred payments were filed for record. The time-payment sales for the preceding week were 672 and for the week before that 873, the highest for any week of this year up to that time.

C. L. Wolf, secretary of the Central Automobile Financing Association, who compiled the figures, said that low or medium priced cars predominated in the sales for the week ending April 1 to a greater extent, probably, than in any previous week.

Dealers also tell of increased sales of the lower priced cars and trucks. One dealer handling a car under \$1,000 and one selling around \$1,500 said his sales for March exceeded his total sales for the preceding three months combined.

ARGENTINE DEMAND BETTER

WASHINGTON, April 12—A cablegram received from Commercial Attache Feely at Buenos Aires says that the demand for moderate and low-priced motor cars in Argentina is improving. March imports from the United States of passenger cars, not including Ford, totaled 301, chassis three, and motor trucks three, as against 42 passenger cars, 28 chassis and eight motor trucks from Europe. Sixty-four motors cars of American and 22 of European makes were imported during the corresponding month last year.

Threaten to Punish Bus and Truck Users

Petitions Reach California Merchants—Railroad Employees Start Boycott

SAN FRANCISCO, April 10—What is looked upon as the most serious movement thus far to curtail the development of motor truck shipping and passenger transportation in California came to light recently at Roseville, Cal. Petitions have been circulated among the merchants of the town asking them not to patronize truck shipping lines under the implied threat of boycott and members of at least one union composed of railroad employees have been notified officially that a stage line has been put on the "We Don't Patronize" list, and if members use the stages they will be subject to fine.

Attempt to Throttle Competition

Roseville is similar to hundreds of "railroad towns" in the United States. The Southern Pacific has repair shops there and they are one of the chief sources of revenue to the community. California had a reputation for years as a railroad-owned state.

The railroads are leaving no stone unturned in their attempt to throttle motor competition. When an applicant for a stage or freight franchise appears before the State Railroad Commission his plea almost invariably is fought by attorneys for the Southern Pacific, Union Pacific and Santa Fe lines. Railroad representatives are addressing the Chambers of Commerce of the various cities and towns.

The most common appeal is that railroads have been responsible for the growth of the community and that freight trucks and stages are jeopardizing their investment. The chambers are told the motors not only are cutting into railroad revenue, but are wrecking the roads built by the people, and that the income derived by the state from these sources is far too small. It is evident that steam and electric carriers would have the motors so burdened by special taxes and the weight restrictions so severe that this competition would be killed by strangulation.

Bitter Toward Motor Vehicles

In addressing a meeting of the Progressive Business Men's Club at Bakersfield, Cal., recently, R. E. Kelly, representing the executive department of the Southern Pacific, protested bitterly against the motor carriers. After reviewing railroad statistics on investments, payrolls, taxes, etc., and pointing out that the railroads maintain their own roadbed and rights of way, and highways are built by public expenditure and are maintained in the same way, Kelly said:

You are business men and know how much you benefit from the payrolls of the railroad companies and from their purchases of supplies here. Southern Pacific men and

their families buy their groceries, their clothes and other necessities of life here. They buy or build their own homes and pay city taxes. When the railroad business prospers they prosper, and the city and other citizens benefit thereby. When the railroad business suffers, as it has in the last year, fewer men are employed, the payrolls shrink and this has a depressing effect on other business. The motor transportation problem is your problem. It is an important problem because it deals with dollars—your dollars.

Railroads have their agents, attorneys or other dependents in almost every locality, although it is estimated there are more than 200 towns in California wholly dependent on motor transportation.

The situation has reached such an extreme that there are boards of county supervisors in the state which have passed resolutions directed to the railroad commission petitioning that body not to issue franchises to motor carriers to serve the same communities that have railroad accommodations until such time as the motor carriers are made to pay their "fair" share of the state taxes. Chambers of Commerce, merchants' associations and other similar organizations throughout the state have been induced to pass similar resolutions.

At Roseville, for the first time on record, the cards have been placed on the table. In this instance, however, the railroads as such are not the active players. The way is left free to declare the action "unauthorized" and "unofficial."

Wages Are Involved

Employees are quoted as having said the railroads claim they cannot afford to continue paying the present wage scales because of inroads on their business by motor carriers. The deduction that employees themselves must take some steps to oppose motor competition if they want their wages maintained, is obvious.

Merchants of Roseville have signed a sworn statement to the effect that G. O. Seward, who represented himself as being president of the Brotherhood of Railway Clerks No. 1044, and a committeeman from the Roseville Labor Council, called on them at their places of business and asked them to sign an agreement not to patronize motor trucks hauling freight into Roseville and not to patronize the stages. The reason assigned for the request was that Roseville was largely supported by the railroad and that the members of the railroad forces were union

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SAXON STARTS AT YPSILANTI

DETROIT, April 12—The Saxon Motor Car Co. has started operations in the plant taken over from the Apex Motor Corp. at Ypsilanti on a schedule of five cars daily. This total will be increased to 10 within two weeks. Harry L. Bill, vice-president, is in charge of operations, with Carl H. Becker in charge of sales and D. C. Bayne, secretary and treasurer. The company reports orders on hand covering several months' production. The new plant affords 32,000 sq. ft. of floor space in a modern reinforced concrete structure.

Industry Meets Film Makers at Washington

Department of Commerce Represented—Reels Would Be Used in Export Trade

WASHINGTON, April 11—Impetus to the movement by national organizations to advertise their products abroad through the medium of educational moving picture films was given when representatives of 25 associations met here with officials from the Department of Commerce.

The automotive industry was represented by Alfred Reeves, general manager of the National Automobile Chamber of Commerce; J. Walter Drake, chairman of the Hupp Motor Car Corp., and George F. Bauer, manager of the foreign trade department of the chamber.

In the automotive field it is proposed that educational films be made showing every phase of the manufacture of automobiles, their utility features and the importance and economics of highway transportation.

The delegates, while here, met with Governor W. P. Harding of the Federal Reserve Board and discussed credits and business conditions throughout the country, especially as they concerned the automotive industry.

The consensus of the delegates, following the interview with Governor Harding, is that the present gain in business "is a steady, healthy growth and is not a spurt."

Agricultural Inquiry Report Far Reaching

WASHINGTON, April 13—Chairman Anderson of the Joint Commission on Agricultural Inquiry announced to-day that the forthcoming transportation report would carry broad and far-reaching recommendations to Congress bearing chiefly on governmental contracts with all transportation systems and agencies, and about an equal number of findings and conclusions addressed to transportation management to producers and shippers.

It is said that the recommendations will include the question of highway transport development. Because of the effect of motor trucks on the extension of the farmers' market and the general growth of rural life, the commission gave particular attention to this phase of the transportation problem.

MAXWELL-CHALMERS SESSIONS

DETROIT, April 13—Maxwell-Chalmers sales supervisors from all parts of the United States are assembled at the factory for a three-day convention. Arthur E. Barker, vice-president in charge of sales, opened the convention. Other speakers were John J. Plath, Maxwell, director of sales, and A. T. Stanton, director of service.

FINANCIAL NOTES

Ajax Rubber Co. for the year ended Dec. 31, 1921, reports a total loss of \$5,205,577 against \$1,333,368 in 1920. The heavy loss was after deducting all expenses, making provisions for depreciation and for rebates due to price reductions and writing down the cost of fabric and crude rubber used during the year in excess of amounts charged to manufacturing costs, together with the amounts necessary to reduce inventories to market prices. In his statement to the stockholders, Horace De Lisser, chairman of the board, said: "The business of the company is now upon such a plane that the predictions of your management heretofore made as to the prospects for the year 1922 may be looked upon as reasonably likely of fulfillment, as rather substantial earnings have already resulted from business operations during the first quarter of the present year."

Stromberg Carburator Co. reports net profits of \$81,670 for the year 1921 after all charges for Federal taxes and interest. This is equivalent to \$1.08 a share on the capital stock outstanding. Profits in the previous year were \$340,101. The total income of the company for the year was \$323,923 as compared with \$787,443 for 1920. The profit and loss surplus at the close of 1921 was \$2,434,339 against \$2,344,943 at the end of 1920. Cash on hand amounted to \$232,459, notes and accounts receivable \$203,763 and inventory \$522,117. Accounts payable totaled \$55,894. Notes payable amounting to \$150,000 were paid off during the year.

Keystone Tire & Rubber Co. for the year ended Dec. 31, 1921, reports net loss of \$678,039 after expenses, interest and taxes as compared with net loss of \$317,705 in the previous year. The balance sheet shows notes and accounts receivable of \$1,353,473 against \$2,437,903 in 1920, and an inventory of \$368,265 on the 1921 date compared to \$860,921 the year before. Notes payable are listed at \$295,000 against \$448,597, and accounts payable of \$121,644 compared to \$255,092.

Vellie Motors Corp. has filed with the Illinois Secretary of State a certificate of the decrease of its capitalization. The par value of common stock has been reduced from \$25 to \$10 a share. The total stock value is lowered from \$2,000,000 to \$1,200,000.

Portage Rubber Co. creditors will receive an initial payment of 40 per cent on their claims from funds received from the purchasers of the plant and inventory. The payment will be made upon recommendation of the trustee in bankruptcy.

Fisher Body Corp. has declared the regular quarterly dividend of \$2.50 on the common and 1½ per cent on the preferred stocks, both payable May 1 to stock of record April 21.

Kelly Springfield Tire Co. has declared a quarterly dividend of \$2 on the 8 per cent preferred stock, payable May 15 to stockholders of record May 1.

Dort Motor Car Co. stock to the number of 75,000 shares no par common is being offered through McClure, Jones & Reed for \$20 a share.

Allis Chalmers Manufacturing Co. has declared a dividend of \$1 on the common stock payable May 15 to stockholders of record April 24.

BETHLEHEM WINS SUIT

PHILADELPHIA, April 8—Charges of infringement and the use of unfair competitive methods brought against the Bethlehem Spark Plug Co., Bethlehem, Pa., by the Heli Co., Belvidere, Ill., have been disposed of by the United States

Appellate Court in a decision which declares invalid the patent rights claimed by the latter company. The decision affirms that of the United States District Court in 1921, from which the Heli Co. took an appeal.

(BULLETIN)

PIERCE-LAFAYETTE MERGER

NEW YORK, April 13—Announcement was made here late to-day that directors of the Pierce-Arrow Motor Car Co. and the Lafayette Motors Co. have agreed, in principle, upon a plan to consolidate the corporations. C. W. Nash will become chairman of the board of the consolidated company and will have entire charge of the operating management. Nash Motors is not involved in the arrangement in any way.

Waivers Assure Success
of Walker Financing Plan

CLEVELAND, April 8—Waivers to 70,000 shares of the stock of H. J. Walker Co. have been received from stockholders in response to the notification sent out by the company that the reorganization syndicate would proceed with the re-financing plan. The success of the plan was contingent upon releases being received to 65,000 shares.

Receivers Have Chance
to Sell Texas Motors

FORT WORTH, April 8—Steps to remove the Texas Motor Car Association from receivership and to halt the bankruptcy proceedings so that the \$4,000,000 plant here can be sold, have been taken before United States Judge Wilson.

The latter proceedings were begun before Judge Wilson by Chicago and Indianapolis creditors. At that time two receivers, who had been appointed by the State court, were in charge of the factory. The receivers now have a chance to sell, it is said, but cannot until the court renders a decision, which is expected in several weeks. In the meantime the plant is closed with the exception of the body department.

Bill Signed for Higher
Fees in New York State

ALBANY, April 10—Governor Miller has signed a bill increasing from \$10 to \$16 the cost of registering a two-ton motor truck and providing an additional tax of \$8 a ton for each ton above two. Another bill signed by him provides a fee of 30 cents per 100 lb. for the registration of automobiles of 3500 lb. weight or less and 75 cents per 100 lb. if the car weighs more than 3500 lb.

Other motor vehicle bills signed by the Governor provide for the approval by the State Tax Commission of headlights used on automobiles and directing the Tax Commission to make frequent inspection of motor trucks operating on state highways to detect violations of the law in regard to overloading.

Last week's local money market displayed continued ease. Call money

BANK CREDITS

Written exclusively for AUTOMOTIVE INDUSTRIES by the Guaranty Trust Co., second largest bank in America.

ranged between 4½ per cent and 5 per cent, as compared with 4 per cent to 5 per cent in the previous week. For time money the situation remained essentially unchanged, fixed date funds being in more liberal supply, but in small demand. The range continued the same as for the previous week, 4½ per cent for sixty and ninety days and four months and 4½ per cent to 4¾ per cent for five and six months' maturities. The range for prime commercial paper remained unchanged at 4½ per cent to 4¾ per cent.

The Federal Reserve statement as of April 5 showed an increase of \$7,846,000 in gold reserves and \$6,222,000 in total reserves. Total bills on hand decreased \$15,370,000, while total earning assets decreased \$6,530,000. There was a decline of \$692,000 in total deposits, while Federal Reserve notes in actual circulation showed an expansion of \$16,229,000. The reserve ratio declined from 77.8 per cent to 77.7 per cent.

The United States Steel Corp.'s monthly report of unfilled tonnage issued April 10 showed a total of unfilled orders on the company's books as of March 31, 1922, of 4,494,148 tons, the highest reported since last September. This total marks an increase of 353,079 tons during the month and compares with 6,284,765 tons on March 1, 1921.

The pig iron output in March reached over 2,000,000 tons, which is the first month since January, 1921, in which production passed the two million ton mark. The daily average reported output for the month of March was over 65,000 tons.

NEW ELGIN DIRECTORS

CHICAGO, April 13—Stockholders of the Elgin Motor Car Corp., which is getting its factory in shape for the production of a series of new models, have elected four new directors. They are A. V. Martin of the State-Lake Bank, Chicago; William Lister, an attorney, and H. W. Jones and J. F. Cornelius, Chicago business men. Members of the board re-elected are C. S. Rieman, president; F. L. Brown and W. G. Knoebler. Prices of the new line have not been announced except that of the phaeton, which will sell at \$1,695, which is an advance of \$300 over the present model.

WHITE 20 PER CENT BETTER

CLEVELAND, April 13—The White Motor Co. reports that its March orders were approximately 20 per cent higher than for any month since May, 1920, and that deliveries exceeded any month since September, 1920. Business for the first quarter in both orders and deliveries shows a material increase over the same quarter last year. Loans have been reduced since Jan. 1 to \$3,300,000, with more than \$2,500,000 cash on hand after a dividend payment of \$500,000 on March 31. All branches reported decided improvement.

INDUSTRIAL NOTES

Universal Tool Co., a New Jersey corporation, has purchased the business conducted at Garwood, N. J., by the Universal Tool Co., a Michigan corporation, which has been in the hands of a receiver for several months. The sale included all the assets of the latter company except its accounts receivable, which should be paid to Thomas H. Keating, the receiver, in Newark. The company expects to enlarge the scope of its manufacturing in the immediate future. The officers are Robert E. Roseberry, president; H. R. McGraw, vice-president; Donald McGraw, treasurer, and G. J. Miller, secretary.

American Felt Co. has opened a modern unit in Detroit for the cutting and fabrication of felts of its own make for the automotive industry. The move is made as a result of the growth of its business in that section and through locating in the center of automotive activities the concern hopes to effect a number of economies as pertain to shipments. The company has also taken into consideration the better service possible and greater convenience for contact between automotive engineers and its own. Principal offices of the concern are located in New York, Chicago and Boston.

Martin-Parry Corp. has closed a lease with the New Orleans Metal Bed Co. whereby it comes into possession of 10,000 sq. ft. of floor space which it will use as a branch for its products, covering Louisiana and most of Mississippi. This is the fourth distributing center to be established in the South by the body builders, the others being at Atlanta, Houston and Dallas. A. Mitchell is manager of the New Orleans branch.

Industrial Engineering Co. has opened offices in the Peoples' Bank Building, Akron, as consulting and designing engineers on automatic, special and production machinery for the automotive and machinery building industries. Members of the firm are L. C. Hosfield, George C. Winchel, J. C. Sinclair and W. F. Clark.

B. F. Goodrich Co. will hold its annual meeting on April 19, when six three-year directors will be chosen by the common stockholders. A special meeting will be held on the same date for the purpose of conforming the certificate of reorganization to the state corporation law of New York.

Bull Dog Tractor Co., Fond du Lac, Wis., has filed an involuntary petition in bankruptcy. The concern originally was formed at Oshkosh but moved its offices and factory to Fond du Lac about 18 months ago. No statement of assets and liabilities is available at this time.

Elsemann Magneto Corp. will remove its Chicago branch to 2005 South Michigan Avenue on May 8. The change results from the necessity of occupying larger quarters. All repairs will be made in the new branch and a complete stock of magnetos and parts will be carried.

Standard Auto Supply Co., New York, creditors have filed a petition in bankruptcy against Louis A. Weinstein, trading under that name. It is stated that the liabilities approximate \$60,000 and the assets \$20,000. H. Willis Smith has been appointed receiver.

Duplex Storage Battery Co., Beaver Dam, Wis., has filed a voluntary petition in bankruptcy, scheduling its liabilities at \$74,462 and claiming assets of \$58,895. Unsecured claims amount to \$67,497.

Missouri Car Co. of St. Louis has purchased a 10-acre tract in East St. Louis to manufacture street car equipment and to

build bus and commercial vehicle bodies to specification.

Canton Art Metal Co. has removed its sales office from 200 Fifth Avenue, New York, to the Canadian Pacific Building, 342 Madison Avenue.

Wants Chicago Show
Shifted to St. Louis

ST. LOUIS, April 9—A campaign to change the holding of the national automobile show from Chicago to St. Louis has been inaugurated by Webster Colburn, vice-president and general manager of the Dorris Motor Car Co. Colburn has urged the change in letters to Alfred Reeves, general manager of the N. A. C. C., as well as to each member of the chamber.

Colburn's letter to Reeves declares inadequate the Coliseum and Armory in which the Chicago show has been held for years. Visitors, he says, are obliged to walk through "Pneumonia Alley," which connects the buildings, a serious matter in the midwinter weather which prevails at the show season, and making necessary a system of time limit transfer.

He directs attention to the large Chevrolet building in St. Louis, used in the last two local automobile shows, which provided space on one floor for passenger cars, trucks and accessories.

"More Important" Work
Halts Graham Resolution

WASHINGTON, April 11—Consideration of the Graham resolution placing a 90 per cent ad valorem tax on all reimported goods was postponed to-day, when it came up in the Senate, by objection of Senator King of Utah, who insisted that there was more important legislation pending.

Under the provisions of the resolution, which has been endorsed by automobile and supply dealers, as well as by practically every national association of retailers and manufacturers, would prevent the dumping and underselling of cheaply bought government war supplies, on the American market, after they had been purchased abroad.

DEALERS ORDERING TRUCKS

KENOSHA, WIS., April 12—Truck business of the Nash Motors Co. has shown a decided increase in the past 60 days. Dealers in practically all sections of the country, according to General Sales Manager C. B. Voorhis, are ordering trucks in larger numbers than at any time during the past 18 months.

CORRECTION

DETROIT, April 11—AUTOMOTIVE INDUSTRIES was in error in its issue of April 6 in giving the name of the newly incorporated successor to the Lincoln Motor Co. as the Lincoln-Ford Motor Car Co. The name of Ford is not included in the title of the new corporation, which is the Lincoln Motor Car Co.

METAL MARKETS

It is an old trade axiom that the steel market is either a feast or a famine affair, and recent press reports have tended to create the impression that it is once more in the midst of one of its feast periods. Market reporters have had to subsist so long on monotonously drab news that they may well be forgiven for waxing enthusiastic over the change in sentiment that has come over the market, and thus convey perhaps an exaggerated picture of its improvement, which, after all, lies more in the producers' point of view than in an abnormal betterment of the demand. As a basis for commitments on the part of steel buyers it will be well to bear in mind that the enhanced morale of sellers is predicated far more upon expectations than upon present conditions.

The best that can be said for mill operations, from which one may deduce the actual and not the anticipated demand, is that by and large they have reached the 1914 parity. Compared with what the demand was earlier this year this is a notable achievement. At the same time it is only two-thirds of total capacity. Moreover, the steel now being rolled and the visible backlog of orders carry old prices and so far there are no indications of any representative buying at the advanced levels which became effective as asking prices on April 1. In some steel products higher asking prices, while justified on the basis of advances in the raw material, are out of alignment with the demand.

So, for instance, some producers of cold-rolled strip steel have marked their price up \$3 a ton, although the demand, emanating almost solely from the automotive industries, is hardly in excess of 50 per cent of capacity. Naturally high prices make it just so much the more difficult for producers to augment the rate of operations. Undoubtedly there is a latent demand for steel from many industries, other than automotive manufacture, which has so far been suppressed either artificially or by force of circumstances.

Pig Iron.—Nearly all of the passenger motor car builders have figured recently as buyers in the foundry market, presumably at fractional concessions from the \$20 level, which is now the prevailing quotation in the Chicago market.

Steel.—Higher prices are asked for virtually every steel product used in the automotive industries, but fresh buying at these higher prices appears to be in abeyance. Large tonnages of bolts and nuts were contracted for by automotive interests before advances became effective.

Aluminum.—There has been a noteworthy broadening of the demand from the automotive industries. The market has turned strong at previous quotations. Opinion in the trade is that Germany will be able to continue exportation of sheets to the United States, even though the proposed duty of 9 cents per lb. should become part of the tariff law, this because of her cheap labor. Importers are reluctant to quote on July and August deliveries because of tariff uncertainty.

Nickel.—Of considerable interest to the automotive industries is the recently announced reduction in nickel prices by the leading producer. This price cut should tend to broaden the use of nickel steel and nickel-chromium steel. The "outside" market had for some time ruled below the chief interest's quotations, but the latter's price cut is indicative of an energetic policy to broaden the use of nickel, especially in automotive construction.

Calendar

SHOWS

April 8-16—New York, Second Annual Electric Automobile Show, Showroom of the New York Edison Co.

FOREIGN SHOWS

March 10-July 31—Tokio, Japan, Peace Exhibition.

April 16-23—Mexico City, Annual Automobile Show, Auspices of the Automotive Division of the American Chamber of Commerce.

April 22-May 1—Prague, Czechoslovakia, Fourteenth International Automobile Exhibition.

May—Shanghai, Exhibition of Road Building Material.

May, 1922—Quito, Ecuador, Agricultural Exposition, celebrating Centenary of Ecuador. Automotive Section.

May 1-15—The Hague, Automobile Show, also Airplanes and Motorboats. Secretary, Spui 185, The Hague.

May 6-21—Scheveningen, Automobile Show.

May 24-June 5—Barcelona, Spain, Automobile Show under Dealers' Direction.

May 28-June 5—Prague, Motor Show, Hotel de Villa.

July 1-24—London (Olympia), Aircraft Exhibition.

Sept. 1922—Rio de Janeiro, Brazil, Automobile exhibits in connection with the Brazilian Centenary Association Automobillista Brazilera.

Sept. 15-20—The Hague, Automobile Show.

September—Buenos Aires, Argentina, Annual Exhibition, Sociedad Rural Argentina.

October—Paris, Automobile Show.

Oct. 12-23—London (Olympia), International Commercial Vehicle Exhibition.

Nov. 3-11—London (Olympia), Automobile Show.

Nov. 10-Dec. 19—Brussels, Automobile Show, Palais de la Cinquantenaire.

Nov. 29-Dec. 4—London (Olympia), Cycle and Motorcycle Show, British Cycle Motors, The Tower, Warwick Road, Coventry.

November—Buenos Aires, Argentina, Annual Exhibition, Automovil Club Argentino.

CONVENTIONS

April 20-22—Buffalo, N. Y., Sixth Annual Convention of the American Gear Manufacturers Association.

May 8-10—New York, National Association of Manufacturers.

May 10-13—Philadelphia, Ninth National Foreign Trade Convention of the National Foreign Trade Council.

May 12—New York, Annual Meeting, National Highway Traffic Association, at the Automobile Club of America.

May 16-18—Washington, D. C., Annual Meeting of the Chamber of Commerce of the United States.

May 22-25—New York, Palisades Interstate Park, Second National Conference on State Parks, Bear Mountain Inn.

June 11-15—Milwaukee, Annual International Convention of the Associated Advertising Clubs of the World.

June 19-24—Colorado Springs, Summer Meeting, Automotive Equipment Association.

June 26-July 1—Atlantic City, Twenty-fifth Annual Meeting of the American Society for Testing Materials, Chalfonte-Haddon Hall Hotel.

August 28-Sept. 2—Detroit, National Safety Congress.

Sept. 18-23, 1922—Rome, Italy, Second Annual Meeting of the International Chamber of Commerce.

S. A. E. MEETINGS

Detroit, April 21, May 26.

June 20-24—White Sulphur Springs, W. Va., 1922 Summer meeting of Society of Automotive Engineers.

Threaten to Punish Bus and Truck Users

Petitions Reach California Merchants—Railroad Employees Start Boycott

(Continued from page 843)

men. As such it was much better for them to have the railroads patronized in preference to the trucks and stages. The affidavit also says the subscribing witnesses were told by Seward that unless they signed the agreement employees of the railroad would be notified not to trade with them, and if the employees did deal with those merchants, Seward would use his influence to have the employees discharged.

As further evidence of the attempt at railroad union "blacklisting," there is cited copy of a notice signed by J. L. Longhurst, recording secretary, and said to have been sent to members of the United Brotherhood of Carpenters and Joiners of America. This notice states that at a meeting of Roseville Local No. 1147 action was taken authorizing a fine be levied on members who patronize the Roseville-Sacramento stage line. This fine is to be \$1 for the first violation of the order and \$5 for the second and subsequent offenses.

The outcome of these tactics is that some of the merchants of Roseville expect to comply with the demands of the unions. Others so fear the loss of railroad employee business that they say they contemplate advertising in the local newspaper "We are 100 per cent Southern Pacific Merchants." The operator of a truck freight line stated that previous to the action of the unions his income from daily haulage into Roseville averaged about \$20, but since the manifesto it has been no more than \$2. The driver

of the Roseville-Sacramento stage reports the ban is being felt by him. The morning of March 25 he had only 44 passengers, nearly all women and salesmen, and he did not recognize one union man among his patrons.

Protest has been made to the Railroad Commission of California by representatives of the motor carriers, but that body claims to have no jurisdiction. There is some talk of taking the matter into the courts on the grounds of collusion, but this probably would be difficult to prove. Railroad employees claim they have not forgotten that at the time of the last railroad strike in California complete transportation stagnation was prevented solely by motor carriers. In the Roseville instance, some of them say, they are battling a foe common to both the interests of themselves and their employers.

AMERICAN PRICES LOWERED

PLAINFIELD, N. J., April 13—Reductions in the prices of its various models are announced by the American Motors Corp. They follow:

	Old Price	New Price
5-passenger Phaeton....	\$2,195	\$1,850
7-passenger Phaeton....	2,195	1,925
4-passenger Sport.....	2,250	1,995
5-passenger Sedan.....	3,150	2,695

MIDWEST REORGANIZATION

INDIANAPOLIS, April 13—Plans for the reorganization and refinancing of the Midwest Engine Co. are so nearly completed that for the purpose of clearing titles, etc., the reorganization committee has taken the final step and had receivers appointed. Business will be carried on in the usual manner. Production and sales activities will continue without interruption. Lon R. Smith will be sales manager under the direction of O. E. Stevens and Frederick Van Nuys, the receivers.

Federal Tax Greater Than Wage for Labor

For Every \$1 on Payroll in 1921, General Tire Company Paid Government \$1.10

AKRON, April 8—"Supporting American industry's contention that present high taxes tend to cripple development and even to drive active capital into hiding, we have compiled figures showing that for every dollar our company paid last year to our productive labor we paid \$1.10 in taxes," announces William O'Neil, vice-president and general manager of the General Tire & Rubber Co.

The General company's total taxes exceeded the amount paid productive labor by 10 per cent, while the company's excise tax alone for 1921 was larger by \$1,000 than the productive labor payroll. Total taxes paid by the company, O'Neil states, were over 88 per cent of the entire payroll covering productive and all other kinds of labor for the year.

In the last three years, the company estimates, General has paid nearly three times as much in taxes as in dividends to stockholders, all of whom paid one hundred cents on the dollar for their holdings. The General company was one of the few tire companies in the country to continue dividend payments during the slump period, General preferred stock earning 8 per cent dividends and common stock earning 10 per cent last year.

HARPER DISTRIBUTES DURANT

NEW YORK, April 11—R. H. Harper, who formerly was head of the Harper-Overland Co. in Washington, has been appointed distributor of the Durant line for the District of Columbia, Virginia and parts of West Virginia, Maryland and Tennessee.

AUTOMOTIVE INDUSTRIES

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No. 16

Hoover and the Trade Associations

Secretary of Commerce has outlined functions of trade associations. He is promoting his ideals by co-operating with such organizations. Automotive industry Contact Committee formed on foreign trade. Program warrants manufacturers' support.

By Norman G. Shidle

HERBERT HOOVER is giving to many trade associations and to many trade association members a conception of the functions of such organizations that are very largely new. And the associations are rising to meet the Hoover ideal.

Hoover believes that the trade association has some fifty or sixty constructive functions, and he is quietly but constructively showing trade association members and secretaries how they can fulfill a larger field of usefulness than has been the aim or idea of many in the past. The Hoover trade association ideal is worth the serious attention of every automotive executive directly or indirectly connected with trade association activities.

Hoover has taken for granted the idea that trade associations have been formed primarily to perform the constructive functions which lie within their power. He believes in the fundamental honesty of the majority of American business men; that American business recognizes that in the long run the best interests of the public are identical with the best interests of business.

These opinions attributed to Mr. Hoover are not quotations, but rather an interpretation of the attitude of the Secretary of Commerce as noted in his

various public utterances about trade associations in general and in his meeting with the trade association secretaries in Washington last week in particular.

Many trade associations were not formed primarily for the broad educational purposes outlined by Hoover as the real function of such organizations. Nevertheless, it is true that their future growth and progress depend primarily upon a recognition of these possibilities and an attempt to fulfill them to the highest degree.

Over 500 people, interested in or connected with trade associations in an official capacity, met with Hoover in Washington last week and discussed trade associations and their activities. The men at that meeting were given an accurate conception of what a real trade association might do in the way of public service and what assistance the Department of Commerce may be expected to render.

"The trade association is a college of business," Hoover stated. "So long as its activities are such as to fulfill that primary educational function, no question of law will ever bother it. It is when it steps outside of this educational field that it goes into the twilight zone.

"There are so many useful constructive functions

for a trade association to perform that it seems foolish to take the changes entailed in entering that twilight zone. Moreover, it is doubtful whether or not there is any real economic advantage to be gained by members of the trade association through the activities in this twilight zone. The commercial value to members of such activities has been greatly exaggerated."

By emphasizing the possible constructive functions of the trade association Hoover is focusing attention upon the really essential phase of the whole trade association discussion. The individual members of a trade association will benefit far more in the long run through constructive association activities useful to the public welfare than by the conduct of such secret activities as might give to those members a temporary commercial advantage. This fundamental fact is true regardless of the restraint of trade act.

Manufacturing organizations in the automotive industry are facing problems of marketing and production such as have never confronted them before. The amount of commercial and engineering research necessary during the next few years is tremendous. Trade associations capable of visualizing these problems and attacking them in a constructive way are a part of the automotive industry. Any organization busy studying and solving these problems will have little time left for illegitimate activities.

Whatever statistical data are needed for the illumination of such studies can be gathered without much danger of legal interference. Data for such purposes constitute part of the educational function of the trade association. Publication of such figures is desirable, if for no other reason than to make perfectly obvious the fact that compilation has been for purposes of research in keeping with the best interests of the entire social and business community. Prices are not nearly so essential as much other data, and Hoover believes an association wise to refrain from gathering price data.

Hoover says that legitimate trade association activity is vital and must be encouraged, and that of the 2000 trade associations in this country, a vast majority are concerned wholly with such legitimate activities. He emphasizes, however, the fact that the Department of Commerce, in its offer to receive statistics from trade associations and disseminate them to the public, cannot in any way deal with the so-called open price associations. Moreover, the Department has not and will not attempt to interpret the law.

The Department of Commerce is not only outlining the many constructive functions of the trade association, but is putting its ideas into practice. In its efforts to co-operate practically and constructively with American business, it is making excellent use of the facilities for contact and co-operative work given by the various trade associations.

There is no better example of this than the vital activities which are being carried on by Gordon Lee, Chief of the Automotive Division of the Bureau of Foreign and Domestic Commerce. The activities and general purposes of this division have been outlined previously in AUTOMOTIVE INDUSTRIES. Constructive work has been going on for over a year. Last week, however, organization

was completed of a Contact Committee which will enable the Automotive Division to function even more closely and practically in the interests of the automotive industry.

On this Contact Committee is represented every section of the various groups comprising the automotive industry. The various trade associations of the industry have been utilized in its formation. Cars, trucks, motorboats, aircraft, motorcycles, parts, accessories, automotive equipment and automotive business publications are all represented on this committee which will advise with the Automotive Division constantly in the working out of the practical current foreign and domestic trade problems which come up from day to day.

Gordon Lee has been working on the formation of this liaison body for many months. Last week it held its first meeting. The event was more important than might be recognized at first glance. The gathering of this Contact Committee marked the first coming together of all groups of the automotive industry for a joint consideration of the problems and opportunities of selling American automotive products in foreign countries.

The committee consists of J. Walter Drake (Hupp Motor Car Corp.) and George F. Bauer, chairman and secretary of the foreign trade committee of the National Automobile Chamber of Commerce; W. O. Rutherford (International B. F. Goodrich Corp.) and M. Lincoln Schuster, chairman and secretary of the foreign trade committee of the Motor and Accessory Manufacturers' Association; W. G. McCann (Hendee Manufacturing Co.), chairman, foreign trade committee Motorcycle and Allied Trades Association; S. D. Black and G. W. Brogan (both of Black & Decker Mfg. Co.)

of the Automotive Equipment Association; Luther K. Bell, secretary Aeronautical Chamber of Commerce; Ira Hand, secretary of the National Association of Engine and Boat Manufacturers, and George E. Quisenberry of the Class Journal Co. Additional members of this committee, but not present at the Washington meeting, are W. E. Green, representing the Association of Automotive Equipment Manufacturers, and Don F. Whittaker, secretary, foreign trade committee of the National Association of Motor Truck Industries.

The representatives of these various automotive organizations sat around a small table for eight hours and laid a firm foundation for the promotion of American automotive business abroad. They learned of the expert commercial information service that the Automotive Division is utilizing in all the principal countries of the world; how the needs of the different automotive manufacturers in the way of information and service were being met; how the Automotive Division has been turned into an efficient commercial organization functioning in a prompt manner.

The formation of this Automotive Division Contact Committee is typical of the way in which Hoover is promoting and utilizing the constructive features and possibilities of trade associations. The automotive industry is in an excellent position to benefit both by helping its trade associations to fulfill their very constructive aims and by co-operating with the Department of Commerce in its efforts to help American business.

HOOVER seems to be more interested in having trade associations fulfill the constructive mission for which they have been formed than in discussing how near it is possible to come to breaking the law without actually doing so. He calls the trade association a "college of business" and says that "legitimate association work is vital and must be encouraged."

Constructive possibilities are being shown by cooperation between Automotive Division of Bureau of Foreign and Domestic Commerce and representatives of various trade groups within the automotive industry.

British Oil-Cooled Car Engines

Originally introduced for motorcycles oil-cooling system is now applied to two and four cylinder car engines. It holds possibilities for higher efficiency, lower cost of production and greater ease of maintenance.

By M. W. Bourdon

AT the British Motorcycle Show of 1920 there appeared an engine utilizing the crankcase oil for cylinder and piston cooling. It was designed by Granville M. Bradshaw, whose success as a designer of air-cooled airplane engines during the war brought him into considerable prominence in England.

He became convinced that air-cooled engines are really oil-cooled, and that even water-cooled engines depend upon the lubricating oil quite as much as, if not more than, upon the water for conveying the heat away from the hottest part, the piston.

Bradshaw was led to this conclusion by experiments with an air-cooled stationary engine for driving wireless and searchlight dynamos. The first of these had a large fan placed at some distance for test purposes, with the result that it directed a portion of the air draught onto the crankcase. The engine ran on its first test under full throttle for 15 hours a day for ten consecutive days, without trouble. But later the design was modified to make a more compact unit with an enclosed centrifugal blower which directed the air through ducts directly on to the cylinder heads. The result was the engine would not develop the same power, nor run satisfactorily for long periods, and the crankcase became so hot that it actually melted the insulation of the magneto attached to it.

This experience showed that much of the heat absorbed

by the combustion chamber walls is carried off by the crankcase oil. Later experiments by Bradshaw confirmed these results and subsequently Dr. Gibson, in his paper read before the I.A.E. indicated to what extent the crankcase and oil circulation assist cooling.

In two cases instanced he had proved that 40 and 47 per cent respectively, of the total heat absorbed by the walls was dissipated from the crankcase of engines in which that feature was not contemplated by the designer.

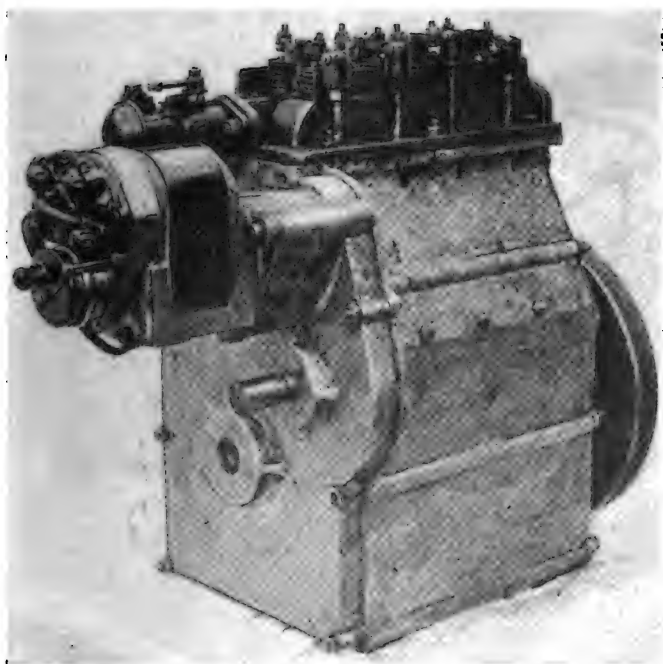
It occurred to Bradshaw, therefore, that if nearly half the cooling of an engine is accomplished by the crankcase unintentionally, a great deal more could be done in that way in an engine designed with that end in view, and he set to work to apply the idea in a practical form.

Development of Oil-Cooled Engines

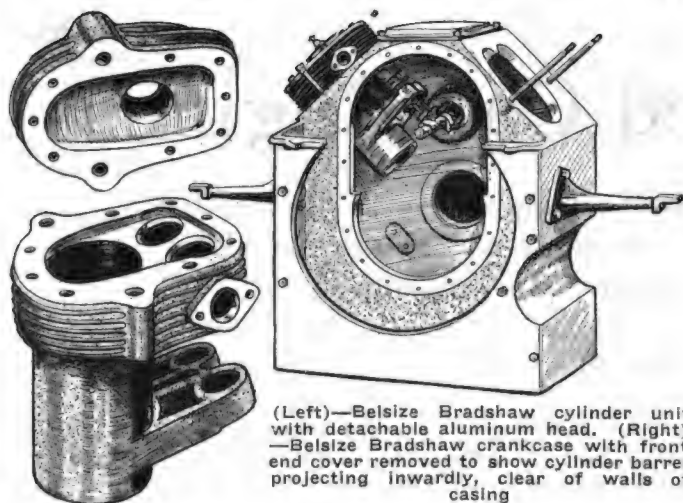
In the first attempt to make better use of the lubricating oil as a cooling medium (the motorcycle engine referred to) overhead pushrod-operated valves were used and dependence placed upon an air-cooled cylinder head for heat radiation. In his next move in connection with oil-cooling, he adopted an L head cylinder, and found that with this arrangement he was able to secure advantages which more than compensated for the loss of benefits generally ascribed to overhead valves; he was able to increase the area of parts cooled by oil and to include among these the valve seatings and stems, leaving air-cooling to take care of the top of the combustion chamber only.

At the Olympia Show in November last an oil-cooled two-cylinder Vee engine designed by Bradshaw was exhibited by the Belsize Co., one of the oldest of British motor manufacturers, with a plant capable of turning out about 50 to 60 chassis per week. Bradshaw, who is an independent engineer, was commissioned to design a light car with a two-cylinder engine; he submitted the oil-cooled engine, which was accepted after prolonged tests and put in production. Deliveries of the car began in December, and to all appearances, it is giving satisfaction to users.

The crankcase is an aluminum casting of exceptional size for an engine of these dimensions ($3\frac{3}{4} \times 4\frac{3}{4}$ in. approx. 83 cu. in.). It has a detachable end plate which supports the camshaft and crankshaft bearings at the front, while a forward extension of the main casting partially encloses the vaned flywheel, from which an air draft is directed upward to issue through sheet aluminum cowlings. The cylinders are of cast iron with detachable die-cast aluminum heads and bronze bosses screwed into the aluminum for the spark plugs; only the heads and the finned combustion chambers project from the crankcase, the whole length of each cylinder barrel extending into the case, well clear of the sides of the latter. Cast with the cylinder barrels are lugs for the guides of the cam followers, and an important point is that the undersides of the valve seats in the cylinder casting are exposed to the crankcase interior.



Marsell oil-cooled four-cylinder $2\frac{1}{2} \times 3\frac{3}{4}$ -in. engine, with ball bearing crankshaft. Cylinder barrel unit projects into crankcase, being secured by studs and nuts to underside of detachable cylinder head



(Left)—Belsize Bradshaw cylinder unit with detachable aluminum head. (Right)—Belsize Bradshaw crankcase with front cover removed to show cylinder barrel projecting inwardly, clear of walls of casing

Two gallons of lubricating oil represent a full charge for the crankcase sump, and, at the normal engine speed (1000 r.p.m.), this is circulated at the rate of one gallon per minute by a centrifugal pump. The oil is delivered at high pressure via the main bearings and through the drilled crankshaft to the big-end bearings, whence a far greater quantity than usual is thrown off onto the inside and outside of the cylinder barrels, the inside of the pistons, the underside of the valve seats and the valve stems, as well as the camshaft, distribution chain, etc. All these parts are constantly drenched with oil. Instead of the heat from the piston crown, normally the hottest part of an engine, having to be carried off via the piston and cylinder walls, it is carried off directly from below by the large amount of oil which reaches it. Although cooling by this means occurs in any engine, usually there is insufficient lubricant in circulation in either of the latter types to be really effective as a piston cooling agent.

The large size of the crankcase serves not merely to allow the free circulation of the foam of oil about the cylinder barrels, etc., for it also provides a big surface—approximately 15 sq. ft.—from which the heat can radiate. In consequence, Bradshaw claims, the oil never exceeds a temperature of 190 deg. Fahr., and carbon deposit is not formed under the crown, which tends further to facilitate removal of the heat.

One of the objections to air-cooling is that the resonance of the unjacketed cylinder gives rise to excessive valve clatter and other noises. The large quantity of oil flying around in the Bradshaw crankcase serves as well as a water jacket in deadening sounds, and the engine runs as quietly as a water-cooled one of the same general type.

Bradshaw does not concern himself much with the cooling of the combustion chamber and cylinder head, but maintains that the prime essential is to keep the piston and valve seats cool. While, therefore, it is perhaps not quite correct to view this engine as oil-cooled alone, because of the air draught delivered on to the cylinder heads through cowling from the vaned flywheel in front, one is justified practically in almost ignoring the air-cooling feature.

It will probably be suggested that with so much oil in circulation, an excessive quantity will find its way into the combustion chamber and cause a smoky exhaust. But this does not occur in practice, at least not while the engine is comparatively new.

Nor is any very special means provided for preventing oil from working past the piston. The latter is of the usual cast iron straight-sided type and has two compression rings in the crown and a scraper ring in the skirt, the scraper having its upper edge chamfered off so that the oil film on the cylinder wall is but slightly disturbed

on the upstroke, though the excess is cleared off on the downstroke. To prevent oil from being drawn up through the inlet valve guides when the engine is running on small throttle, the stem and spring of each inlet valve is guarded by a metal cover. It is the writer's opinion that "oil pumping" in both air and water-cooled engines is primarily due to cylinder distortion.

It will be observed that Bradshaw—differing in this respect from the designer of another oil-cooled engine to be referred to later—does not fit baffle plates to shield the lower ends of the cylinder barrels. He holds that their presence would prevent the efficient and direct cooling of the piston crown. As it is, the large quantity of oil thrown up against the inside of the piston prevents, to a marked extent, the formation of carbon on any part of it, and the crankcase oil in consequence keeps peculiarly free from gritty carbon.

Offhand it might be imagined that oil consumption would be excessive, but with the foregoing in mind it is not surprising to find the reverse is the case. Bradshaw claims that the oil temperature never exceeds 190 deg. Fahr. and under normal running conditions its average temperature is only 150 deg.

He also claims elimination of cylinder and piston distortion, and as a consequence of this and of the shorter time the combustion chamber walls and cylinder head take to reach their normal working temperature, reduced crankcase dilution.

An obvious development is a four-cylinder oil-cooled engine with vertical cylinders in line, and Bradshaw is known to be working on one. Such an engine has actually been built by another engineer. It is a 10-hp. 62 x 90 mm. motor (67 cu. in.). Overhead valves are used in a detachable head, the seats being partially exposed from below to the interior of the crankcase extension, which rises as far as the top of the separate block-cast cylinder barrels. The latter project $5\frac{1}{2}$ in. into the crankcase, clear of the walls of the latter, and are cooled by oil delivered in large quantities upon them from two horizontal perforated pipes, one at each side just below the cylinder head inside the crankcase. The remainder of the parts are lubricated by simple splash; a positive cascade of oil falls off the lower



Front view of Belsize Bradshaw engine showing vaned flywheel and cowling directing air draught on to cylinder heads

A New Type of Compensating Differential

The design is such that maximum differential action occurs at low axle speeds and the resistance increases with the speed. As compensation is made for variation in tractive ability, it is not a positive locking type.

A COMPENSATING differential has been placed on the market which utilizes the effects produced by fluid friction and is so designed that the maximum differential action takes place at low axle speeds. The resistance provided by the construction—which is not complicated—increases as the speed increases, tending to reduce the differential action at high speeds. The principles involved are apparent upon an examination of the construction.

This differential consists structurally of an outer case similar to that of an ordinary bevel gear differential, to which the power from the engine is transmitted in the usual way. It is of such general dimensions as to permit its installation in the average axle without alteration. Power from the engine is transmitted to the case, on which is mounted the conventional master gear. From the case it is transmitted through double eccentric rollers to two central driving plates provided with suitable holes for journaling these rollers. The two driving plates also constitute an external and internal gear, respectively, which mesh with mating external and internal gears fastened to the two axle drive shaft sections, respectively. The arrangement is such that the driving plate external-internal gear unit can swing around the axis of the double eccentric rollers when actuated to do so by the gears on the axle drive shaft sections.

The double eccentric gearset forms a reverse motion as required in a differential. When motion in the differential is induced, as in turning corners, the internal gear on the end of one axle shaft and the external gear on the other axle shaft turn in opposite directions. The compensating action of the two gear plates between the two shaft gears consists in a swinging gyratory motion around the centers of the supporting rollers. This gyratory motion causes the rollers to rotate on their axes at a much greater rate than the shaft gear, the ratio on the Ford installation

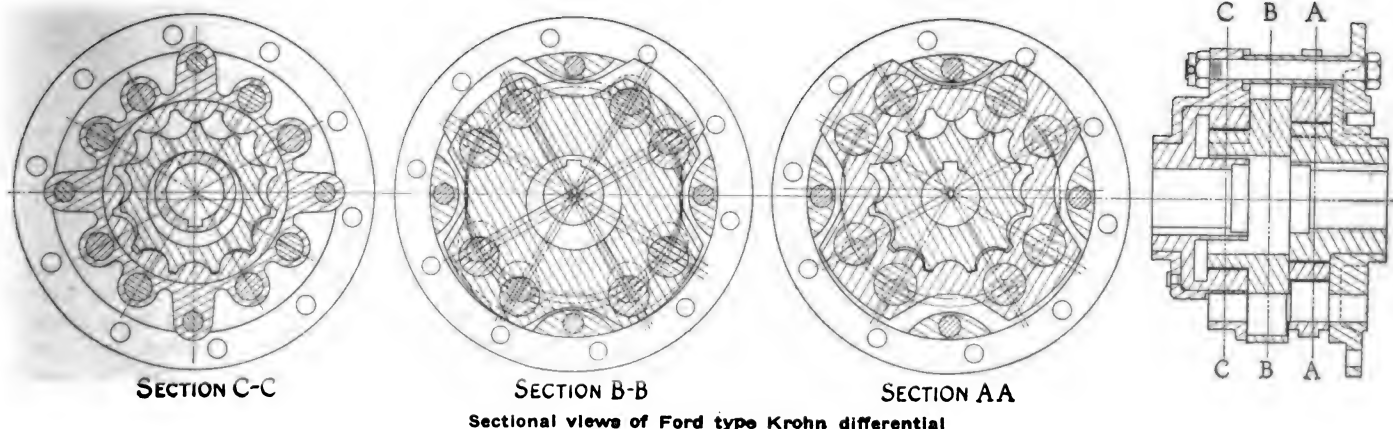
being 12 to 1. The degree of resistance offered can be varied by changing the ratio through the medium of a change in the eccentrics. The rollers being numerous and having comparatively large areas, when running in oil, offer considerable resistance to acceleration of speed. At the low speed of differential action the resistance to turning is low, but when the driving forces tend toward higher differential action abnormal resistance at an increasing rate is inserted, following the law of frictional resistance.



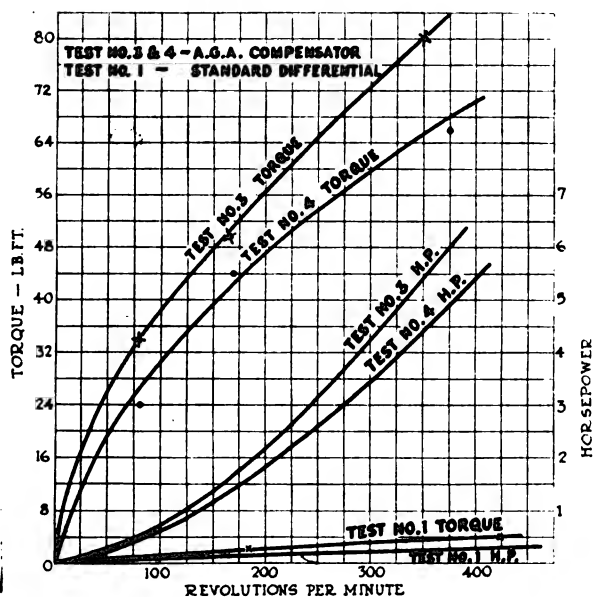
Parts of Ford type Krohn differential

In actual operation, when one of the wheels is off the ground momentarily or on a slippery spot, and differential action is induced by a difference in tractive ability, the tendency to accelerate this wheel is opposed by the internal resistance in the differential mechanism. It will be seen that it is not a positive locking differential but one in which some compensation is made for variation in tractive ability.

The Krohn differential is now being supplied by the H. McFarlane Co. of Chicago as a replacement for the



Sectional views of Ford type Krohn differential



Test curves of Ford type Krohn differential

regular Ford differential, but the device is being built in several sizes for truck and passenger car installation. A

test on a prony brake to determine the amount of power being delivered to the free or semi-free driving wheel was made and the graph shown represents the results of this test.

The tests referred to were based on the following reasoning: If an ideal compensator could be made, a car equipped with it could pass over otherwise impassable ground without noticeable interruption in its motion, provided that road conditions were not such that both wheels lost traction at the same time, when no amount of power applied to the driving wheels would pull the car out. A spinning wheel always has a slight amount of tractive effort, and in the Krohn compensator this reacts to increase the pressure of the rollers on their bearings. How much this actually benefits the action of the Krohn differential it is impossible to accurately determine in a block test such as that described here.

Tests Nos. 3 and 4 give relative values which tend to establish the assumption as correct. The curves of test No. 3 show the difference between the two scale readings and consequently, measure only the internal resistance of the compensator. In the standard bevel gear differential none of these conditions seem to apply, and this test was run with one wheel entirely free. The graph shows the torque curves obtained, as well as the hp. curves computed from the torque values.

Means for Taking Up End Play of Spring Eyes

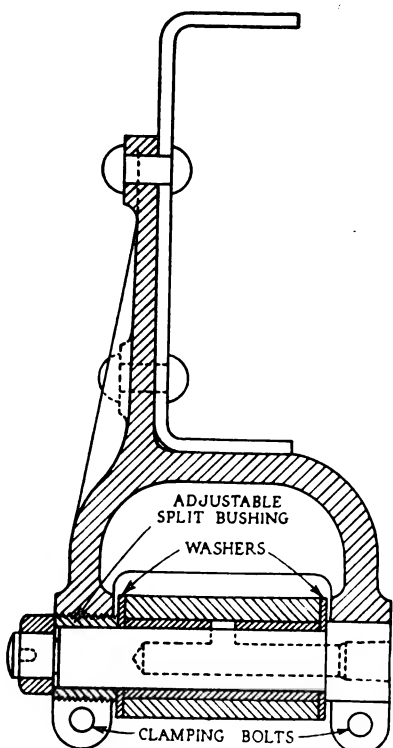
CENTRIFUGAL force puts considerable pressure on the thrust washers of chassis springs when the car is turning a corner at any speed, and as on rough roads there is a continuous rocking motion of the spring eyes relative to the thrust bearings, a good deal of wear occurs and spring eyes eventually develop considerable play. In the majority of cars there are no means for taking up this play; in fact, many cars have no special thrust washers

on the spring bolts, and the result is that in time the car rattles.

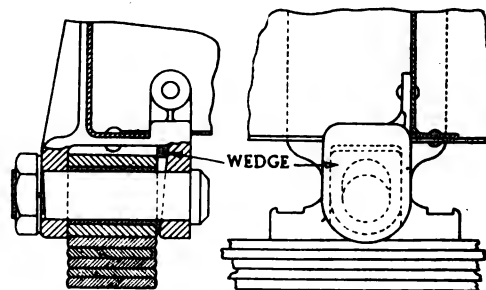
A. C. Schulz, who was formerly connected with the engineering department of the Locomobile Co. and about a year ago brought out the Navarre car, has invented a means for readily adjusting the spring bolts to take up the end play. Two different designs have been worked out. The spring bolt in each design is provided with a head which is clamped in one arm of the spring bracket. The other arm of the bracket is threaded and also split, and receives a split, threaded bushing. The spring eye is bushed in the usual way and two thrust washers are

threaded over the bolt, one resting against the bolt head and the other against the split bushing. End play is taken up by adjusting the bushing, which is then locked in position by clamping the split yoke arm upon it. In one of the designs the spring bolt is provided with a nut, while in the other the bolt is held solely by clamping in the arms of the spring bracket. This latter is intended especially for front spring horns, where projections are objectionable.

A SIMPLE means for taking up wear at the ends of spring eyes and the inner side of the lugs of spring brackets has been invented by Hugo Gibson. It is well known that such looseness is the cause of annoying rattle



Sectional view of spring eye end play adjuster



Sectional views showing wedge action

in many old cars. Mr. Gibson finishes the inner side of one lug of the spring bracket off at an angle and places a wedge-shaped washer over the spring bolt between the spring eye and the lug of the bracket. The washer is made with an elongated hole and of such thickness that when it is first put on when the car is assembled, all of the clearance space of the hole is above the spring bolt. Then, as wear takes place, the washer sinks to a lower position, thus taking up the looseness created and preventing side play and rattle. The device can be used equally well with spring shackles.

Rear Wheel Dynamometer Tests and Their Significance to the Engineer

A description of the car testing apparatus installed at the Sheffield Scientific School and the methods followed in its use. Results of tests of various cars with this equipment furnish much information regarding performance under road conditions which is worthy of careful study.

By Herbert Chase

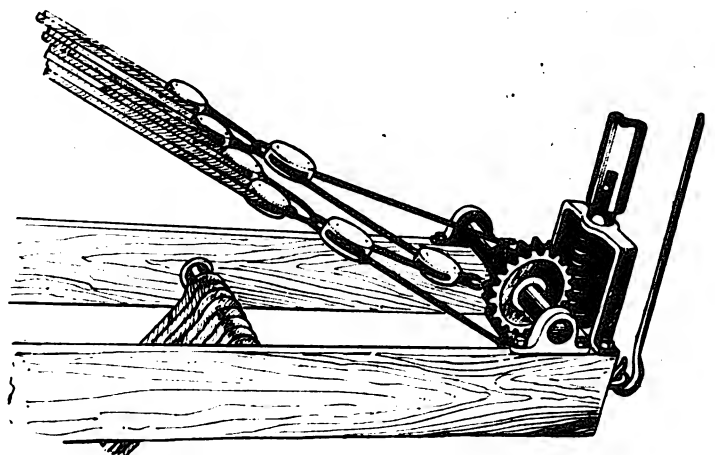
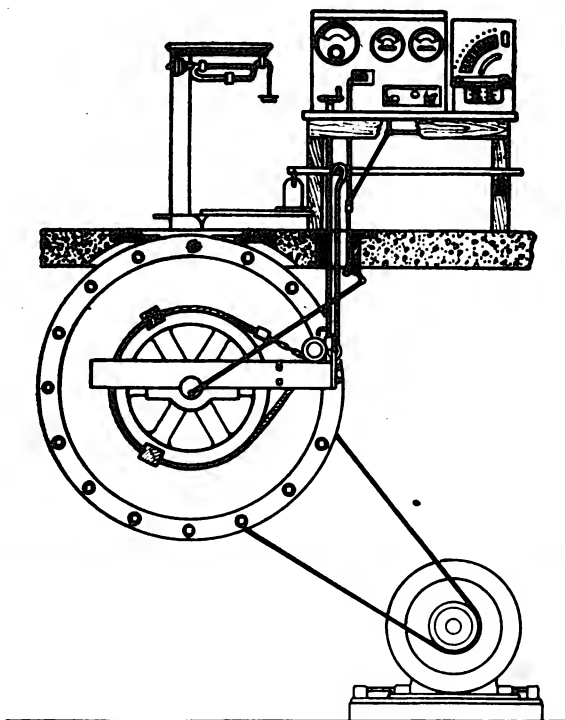
REAR-WHEEL testing dynamometers are not a new thing in the automotive industry, but it is surprising how few data regarding tests made with them have been published and how small a part of the information in this regard which does exist has resulted from tests made under conditions which approximate normal running on the road. As an illustration of the general lack of information along this line, it may be said that few engineers realize that it requires less than 3 hp. exerted at the rim of the driving wheels to propel most passenger cars on a hard level road at a speed of 20 m.p.h., and that, under these conditions the engine is required to develop seldom more than 6 hp. and often less than 5 hp. It seems safe to say that, were these facts and others of a closely related nature fully appreciated, more attention would be given to securing better economy at low loads and less to maximum load performance, a condition which is encountered so small a part of the time under normal operation.

With these facts in mind, let us first consider the simple apparatus required for rear-wheel testing, and then examine the methods employed and some of the results obtained by the use of such equipment in the Mason Laboratory at Sheffield Scientific School, Yale University.

The dynamometer in question is in direct charge of Prof. E. H. Lockwood, who is responsible not only for the design of most of the equipment, but for the logical, if somewhat unusual, methods followed in making the tests here recorded.

The accompanying cuts give an excellent idea of the important elements of the testing equipment. A pair of paper pulleys measuring about 5 ft. 8 in. in diameter are mounted upon a heavy shaft carried in a pair of hangers with plain ring-oiled bearings. The hangers are so arranged that the face of the drums comes approximately flush with the floor on which the car to be tested is located. The drums upon which the car wheels rest have a 15-in. face and the circumference is such that the drums make precisely 300 revolutions per mile of travel of a point on the circumference. Being about twice the diameter of the average tire, the surface of contact with the tire is only slightly convex, and consequently it closely approximates a hard, smooth road surface. The compressed paper also affords good traction for rubber tires.

Overhung on one end of the drum shaft is a cast iron brake pulley 36 in. in diameter by 8 in. face. This pulley has flanges facing inward and thus forming a channel



Left, diagrammatic view of the rear wheel dynamometer, showing rope type prony brake, drums, weighing and recording equipment, etc.

Above, detail sketch of the mechanism used for tightening the rope on the prony brake and thereby varying the load. The worm shaft is free to move vertically in the slotted sleeve which is connected to the hand wheel shaft on the control table seen in the diagram at the left.

which can be kept partly filled with water, the evaporation of which prevents the braking surface from becoming overheated. On this surface bear eight parallel bands of $\frac{3}{4}$ -in. rope arranged in the manner shown in the accompanying cut. It will be noted that the ends of each of the four rope slings are attached to a bar carried between the side members of a box-shaped brake arm, while the loops are carried on four small pulleys attached to a small block and fall. One end of the light cable used in the block and fall is attached to the brake arm, while the other end passes around the horizontal shaft of a small worm wheel carried on the brake arm. The shaft of the meshing worm is vertical and carries a pin, the ends of which can move



View of the paper dynamometer drums suspended from hangers underneath floor of testing room. Note prony brake and motor used in driving drums when making measurements of rolling friction.

vertically without restraint in a slotted sleeve carried on the lower end of a shaft which projects upward through the floor to a control wheel on the floor above. Turning the hand wheel varies the pull on the cable of the block and fall, and thus tightens or loosens the rope slings with corresponding variation in the load imposed upon the brake. The pulley system of the block and fall serves to equalize the pull on the rope slings and assists in giving a smooth and easily operated brake. The wooden blocks shown on the brake surface are grooved to receive the rope strands, and act only as separators.

The slotted sleeve does not interfere with free motion of the brake arm, the pull on which is measured on a platform scales through the linkage shown, due allowance being made for tare.

Between the two drums and mounted upon the same shaft is a second pulley to which is belted a 15-hp. variable speed electric motor which is capable of driving the drums at any speed from 20 to 40 m.p.h. By its use it is possible to determine readily the rolling friction of both the front and rear wheels of the car. An electric tachometer driven off the drum shaft is used to make approximate speed readings, these being checked by means of a positively driven revolution counter and a stop-watch.

Fuel consumption is measured by determining the difference in weight of a tank containing the fuel at the beginning and end of runs. This tank rests on sensitive scales which are kept balanced while adjustments for the run are being made. When the scale beam falls it closes an electric contact which rings a bell and, through a system of magnets, starts the stop-watch and the revolution counter. The counterweight on the fuel scales is then reset to indicate a certain decrease in weight, usually four

to six ounces. When the beam again falls, showing that the amount of fuel in question has been used, the electric circuit is again closed and the stop-watch and revolution counter are automatically stopped. This gives positive and simultaneous measurements of time, fuel consumption and revolutions of the drums, from which readings the speed and rate of fuel consumption are readily figured. The fuel tank is connected to the carburetor by flexible rubber tubing which does not interfere with weight measurement.

Very few cars have sufficient radiation and fan capacity to dissipate all the heat which is absorbed by the jacket water when the engine is operating under full load. It is therefore customary to connect to the radiator drain cock a rubber tube through which cold water from the street mains is mixed with hot water at the base of the radiator in sufficient quantity to prevent boiling of water leaving the engine jacket. It is thus possible to operate the engine with a fairly high jacket temperature but without danger from overheating.

How Tests Are Conducted

The object of the average test made with the apparatus described is to determine the power and economy of the car as a whole, as well as that of the engine under various loads including maximum load and at various speeds. By proper use of the measurements secured in making these tests it is possible to predict within close limits the performance of the car on the road, in particular to learn its rolling resistance and the amount of excess power available for acceleration and hill climbing. Perhaps the most interesting and enlightening tests of all are those made to determine rolling resistance, since it is these measurements, taken together with the computed wind resistance, which determine what load is to be imposed to duplicate the condition of driving on a level road at the various speeds to be considered.

The procedure is as follows:

The front wheels of the car are first placed on the drums and the back wheels are blocked to prevent any fore-and-aft motion. The tires are inflated to the pressure recommended by the tire manufacturer for the size and type of tire in question and this pressure is recorded. The band of the prony brake is slackened so that it is held in contact with the drums only by its own weight. The electric motor which drives the car drums is then started and the drums are turned successively at speeds of 10, 20, 30 and 40 m.p.h. At each speed the r.p.m., brake scale reading and the electrical power input to the motor, as indicated by readings of the voltmeter and ammeter, are noted. The car is then removed from the drums, and the same test repeated, except that the brake band is tightened to give precisely the same volt and ammeter readings as before at the same speed. The increase in the brake scale reading thus becomes a precise measure of the rolling friction of the front wheels, all question as to the efficiency of the electric motor and its belt drive being automatically eliminated so far as results are concerned.

Following this test, the rolling friction of the rear wheels is measured in precisely the same way, this test being made with the change gears in neutral position. The rolling friction of the rear wheels includes, of course, the friction of the reduction gears in the axle housing and that of the propeller shaft and its joints, and the primary shaft of the gearset. It is realized that the friction thus measured is not necessarily the same as that when the parts involved are driving under load, but the difference is probably small, especially at light loads.

Adding the rolling friction of the front wheels to that of the rear wheels and their connecting elements gives, approximately, the total rolling resistance of the car. If

to this be added the wind resistance, we have a measure of the total resistance to motion of the car on a hard, level road or the drawbar pull required to tow the car at the several speeds in question. For the purposes of the test the projected frontal area of the car in square feet is measured and this is multiplied by 0.003 times the square of the speed to give the total wind resistance.

The tractive effort, or reaction of the driving wheels against the ground at uniform speed on a level road must, of course, just equal the rolling resistance of the front wheels, plus the wind resistance at that speed. These factors having been determined from the tests and computations already described, it is an easy matter to make a test substantially duplicating road conditions by simply applying to the car the equivalent brake load. To do this the car is placed with its driving wheels on the drums and is anchored by chains attached to the rear axle and fastened to a horizontal shaft parallel to the rear axle of the car and about the same height above the floor to which it is firmly secured. The front wheels are again blocked and tests made at 10, 20, 30 and 40 m.p.h. as before. There are two tests at each speed, one with a load setting corresponding to level road resistance, and the other at wide open throttle. The difference in power developed as between these two load conditions is, of course, the power available for acceleration or hill climbing. Knowing this power, it is a simple matter to compute the maximum grade which the car can climb in high gear at the particular speed, or its ability to accelerate.

Adding the power developed at the rear wheels to the friction horsepower as computed from the rolling resistance of the rear wheels, already measured, we have the approximate brake horsepower of the engine. Knowing this and the rate of fuel consumption in each of the power tests referred to, the brake m.e.p., fuel consumption per b.h.p. and the other data given in Table I are readily deduced.

A Study of the Test Results

A study of the results of a number of the tests made during the last five years reveals many highly interesting facts which are worthy of study. During this period, upward of 100 cars and a number of trucks have been tested. From these tests some 20 covering a number of representative cars and trucks of various sizes and in various price classes have been selected for tabulation and comparison here. No special effort was made to select test data which reflected particularly meritorious performance, but the data given are thought to be, in general, fairly representative of average performance. In most cases the cars tested were not especially tuned up for the test, but were brought to the laboratory and tested without readjustment, in the same condition under which they were being used by owners. For this reason the tests are not to be regarded, at least in most cases, as indicative of the best performance possible, but rather of a general average performance encountered in normal service.

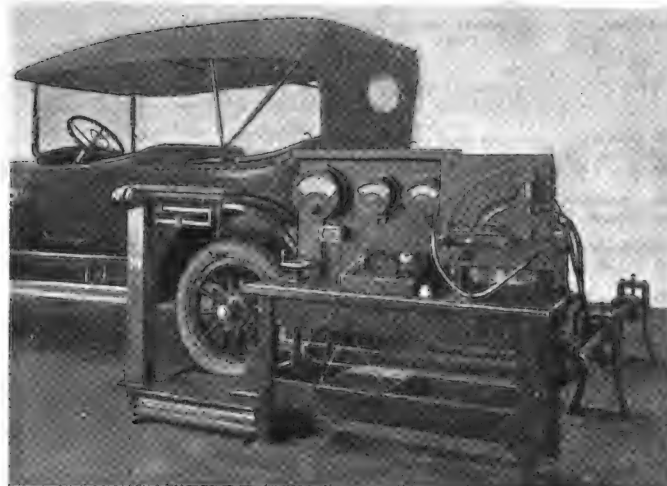
It will be noted that the cars to which the data applies are not of the same age and have not been operated the same number of miles. The price classification is only approximate and refers rather to the present prices of the same or equivalent chassis than to the price in the year when the car was manufactured. Thus, if a car purchased in 1918 cost \$2,500 and the same or an equivalent new chassis now sells for \$1,900, that car is placed in the \$1,500 to \$2,000 class. The price classification refers also to the open phaeton, usually the five-passenger model, even though the particular chassis tested was fitted with a more expensive closed body. The weight given is, however, the actual weight of the car as tested.

Only a few of the possible comparisons which can be

made will be discussed here, since it is evident that various readers will be interested from different angles, but it will be found that the figures are worthy of careful study as an index of general everyday performance.

Rolling Friction

The rolling friction of front wheels is made up of three elements which are not easily separated. They are the friction of the tire itself, friction of the bearings and windage of the wheel turning in the air. Frictional losses in the tire are encountered because of the kneading of the fabric and the rubber as successive sections pass between the wheel and the road. If the casings were perfectly elastic these losses would not occur, that is, the work done in compressing the casing material would all be given back



Car in position for test on the dynamometer. The rear axle of the car is connected by chains to the shaft seen in back of the control table. The chains prevent the car from moving forward.

when the tire again assumes its normal shape. No solid materials are perfectly elastic, and even the best grades of rubber and fabric are a long way from being so, consequently there is a material loss in internal friction which, of course, manifests itself in heat. This frictional loss is much the greatest of the three front wheel losses, the other two being practically negligible at ordinary speeds. Tire losses increase with the load upon the tire and with decrease in inflation pressure, due presumably to the greater deformation under both of these conditions.

It is interesting to note that the rolling friction of a fabric tire is about 50 per cent greater than that of the same size cord tire. This is shown clearly by reference to the results given in the table under the head of rolling resistance of front wheels. Take, for example, cars F and G, which weigh about the same and have the same size of tires inflated to the same pressure, but F having the cord and G fabric tires. The respective rolling resistance is 20.4 and 31 lb. The rolling resistance of front tires is substantially the same in most cases at 20 and at 40 m.p.h., that is, the rolling friction is practically independent of speed, but, of course, the power loss increases directly as the speed. It amounts, in the cases cited, to 1.08 and 1.66 hp. respectively at 20 m.p.h. and to double this at 40 m.p.h. for both front wheels.

The highest front wheel resistance recorded for pneumatic tires is 38 lb. for 36 x 4½-in. cord tires carrying 2565 lb. This is equivalent to 30.2 lb. per ton. The lowest resistance for a pair of front wheels is 17 lb., the tires in this case being 34 x 4-in. cords carrying 1575 lb. or 21.6 lb. per ton.

The rolling resistance of the rear wheels, which, as explained, included the friction of axle bearings and reduc-

Table 1—Results of Rear Wheel Dynamom

CLASS	Speed M.P.H.	Under \$600		\$600 to \$1000		\$1000 to \$1500			\$1500 to \$2000			\$2000 to \$3000		Over \$3000					
		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
Car.....																			
Year—Model.....		1918	1921	1915		1916	1922	1920	1921		1916	1923	1916	1918	1921	1917	1920	1920	1916
No. of Cylinders.....		4	4	4	4	4	4	6	6	8	6	6	8	8	12	6	4	6	6
Bore and Stroke—Inches.....		3 $\frac{1}{4}$ x4	3 $\frac{1}{2}$ x4	3 $\frac{1}{2}$ x4 $\frac{1}{2}$	3 $\frac{1}{2}$ x4 $\frac{1}{2}$	3 $\frac{1}{2}$ x5 $\frac{1}{2}$	3 $\frac{1}{2}$ x4 $\frac{1}{2}$	3 $\frac{1}{2}$ x4 $\frac{1}{2}$	3 $\frac{1}{2}$ x5	2 $\frac{1}{2}$ x4 $\frac{1}{2}$	3 $\frac{1}{2}$ x5	3 $\frac{1}{2}$ x4	3 $\frac{1}{2}$ x5	3 $\frac{1}{2}$ x5 $\frac{1}{2}$	3x5	3 $\frac{1}{2}$ x5 $\frac{1}{2}$	3 $\frac{1}{2}$ x6 $\frac{1}{2}$	4 $\frac{1}{2}$ x5 $\frac{1}{2}$	4 $\frac{1}{2}$ x6 $\frac{1}{2}$
Piston Displacement—Cu. Ins.....		177	171	212	186	243	185.8	241.6	353.8	247	288	199	332	314	424	340	298	525	585
H.P. Rating.....		22.5	21.8	24.03	21	22.0	21	27.3	36	26.5	29.4	25.4	33.8	31.25	43.2	33.7	22.5	48.6	45.7
Wheel Base—Inches.....		100	102	108	109	119	118	118	126	120	123	116	125	125	135	136	132	142	143.5
Weight Lbs. on Wheels.....																			
Front.....		860	1050	1190	990	1575	1390	1440	1600	1510	1560	1380		2000	2250	1800	1825	2300	2565
Rear.....		945	1200	1310	1120	1815	1610	1475	1800	1730	1660	1660		2300	2585	2000	2235	3000	2615
Total.....		1805	2250	2500	2110	3390	3000	2915	3400	3240	3220	3040	3675	4390	4835	3800	4060	5300	5180
Front Tires.....																			
Size.....		30x3 $\frac{1}{2}$	31x4	33x4	30x3 $\frac{1}{2}$	34x4	33x4	33x4	33x4 $\frac{1}{2}$	34x4 $\frac{1}{2}$	34x4	32x4	34x4	35x5	35x5	34x4 $\frac{1}{2}$	32x4 $\frac{1}{2}$	35x5	36x4 $\frac{1}{2}$
Type and Tread.....		F-N	F-S	F-N	F-S	C-R	C-R	C-R	C-S	F-N	-N	C-R		C-N	C-R	C-R	C-N	C-N	C-N
Infl'n Press.....		60	70	60	65	60	65	65	65	70	80	60	65	60	60	55	45	80	80
Rear Tires.....																			
Size.....		30x3 $\frac{1}{2}$	31x4	33x4	30x3 $\frac{1}{2}$	34x4	33x4	33x4	33x4 $\frac{1}{2}$	34x4 $\frac{1}{2}$	34x4	32x4	34x4	35x5	35x5	34x4 $\frac{1}{2}$	32x4 $\frac{1}{2}$	35x5	37x5
Type and Tread.....		F-N	F-N	C-N	F-N	C-R	C-N	F-N	C-N	F-N	-N	C-N	C-N	C-N	C-N	C-R	C-N	C-N	C-N
Infl'n Press.....		60	70	65	70	60	65	65	65	70	80	60	65	60	65	60	65	80	90
Gear Ratio.....		3.63	3.67	3.62	3.55	4.0	5.0	4.0	3.7	4.92	4.08	4.33	4.9	5.2	4.36	3.69	3.62	3.52	3.12
Frontal Area—Sq. Ft.....		21.6	24.1	20.4	16	21.2	27	21.2	21.3	18	22.0	28.0	22.5	25	25	20	18.3	23.0	32.5
Miles Run to Date.....		5,000	300	50,000	1,050	34,000	4,800	3,500	10,700		9,260	500	35,000	7,900	10,100	12,000	8,500	15,000	20,000
Rolling Resistance.....																			
Front Wheels—Lbs.....		20	20.4	27	31	20	17	20.4	31	17.3	32	35	21.6	34	30.5	28	27	27.2	35
Rear Wheels—Lbs.....		40	20.4		32	20	17	20.4	31	17.3	32	35	21.6	34	33.5	30	28.5	27.2	35
Rolling Resistance.....		20	54.9	34	33	25	34	28	44	44.4	52	46	32.5	34	56.5	57	40.5	61.0	79
Complete Car—Lbs.....		40	54.9		35	27	34	35	44	44.4	54	48	35.5	34	57.5	57	40.5	61.0	79
Wind Resistance, Various Speeds, Lbs.....																			
10.....		6.5	7	6.0	4.8	6	8.1	6.4	6.4	5.4	7	8.4	6.7	7.5	7.5	6.0		6.9	9.75
20.....		26.0	29	24	17.2	25	32.4	25.6	25.6	21.6	26	33.6	27	30.5	30.5	24	22	27.6	39.0
30.....		58.5	65	55	47	57	79.9	57.6	57.6	48.6	59	75.6	60	67.5	67.5	55	49.5	62.1	88.0
40.....		104.0		96	77	102	129.6	102.8	102.8	86.4	105	134.4	108	120	120	96	88.0	110.4	156
Tractive Effort, Level Road, Lbs.....																			
10.....		26.9	34	37	24.8	23	28.5	37.4	24	37.4	42	30.0	40.7	36.5	34.5	33		41.9	48
20.....		46.4	56	55	37.2	42	52.8	56.6	43	53.6	61	55.2	61	61	58	51.5	49.2	62.6	77
30.....		78.9	92	86	67	74	93.3	88.6	75	80.6	94	97.2	94	100	96.5	83	76.7	97.1	126
40.....		124.4		128	97	119	150.0	133.8	12	118.4	140	156.0	142	153.5	150	124.5	115.2	145.4	194
Maximum Tractive Effort Direct Drive—Lbs.....																			
10.....		161		202	232	305	290	356	380	412	413	267		580	584	430			653
20.....		198	224	239	263	334	282	250	368	375	418	272	462	577	619	480	359		
30.....		174	194	252	222	310	276	310	369	353	418	224	450	565	621	470	341	695	650
40.....		124		247	175	260	218	270	327	272	376	180	340	540	537	432	330	612	610
Maximum Grade Direct Drive—Per Cent.....																			
10.....		6.9		6.2	8.8	7.7	8.3	10.4	10	11.0	11.0	7.8		12.0	11.0	10.0			10.6
20.....		7.8	7.0	6.9	9.8	7.9	7.3	9.6	9.2	9.4	10.6	6.8	10.4	11.3	11.3	10.8	7.4		9.7
30.....		4.9	4.2	6.3	6.8	6.4	5.8	7.2	8.3	7.5	9.6	4.2	9.3	10.1	10.5	9.8	6.3	11.0	9.7
40.....				4.5	3.5	3.8	2.2	4.4	5.8	4.5	7.0	0.8	5.1	8.3	7.8	7.7	5.1	8.6	7.7
Rear Wheel H.P. Level Road.....																			
10.....		0.72	0.92	0.99		0.61	0.76	1.0	0.63	1.0	1.12	0.8	1.1	0.97	0.92	0.88		1.12	1.28
20.....		2.48	2.99	2.93		2.24	2.82	3.02	2.29	2.86	3.25	2.94	3.5	3.26	3.09	2.75	2.62	3.34	4.03
30.....		6.32	7.36	6.88		6.00	7.46	7.09	5.99	6.55	7.50	7.76	7.5	8.0	7.72	6.64	6.13	7.75	9.95
40.....		13.29		13.65	10.38	12.71	16.0	14.27	12.75	12.6	15.0	16.6	15.2	16.4	16.0	13.27	12.28	15.51	20.5
Rear Wheel H.P. Maximum Developed.....																			
10.....		4.3		5.4	6.21	8.1	7.7	9.5	10.17	11.0	11.0	7.1		15.45	15.6	11.47			
20.....		10.6	12.0	12.8	14.13	17.8	15.1	18.7	19.60	20.0	22.2	14.5	24.7	30.8	33.0	25.60	19.1		34.8
30.....		13.9	15.5	20.2	17.78	24.8	22.1	24.8	29.60	26.8	33.4	17.9	36.0	45.0	49.7	37.60	27.3	56.6	52.1
40.....		13.29		26.4	18.65	27.7	23.3	28.8	34.90	29.0	40.1	19.2	36.3	57.5	57.2	46.1	35.2	65.2	65.0
H.P. Lost—Transmission and Rear Tires.....																			
10.....		1.47	0.91	0.88	0.64	0.91	0.69	1.17	1.17	1.36	1.23	0.87	0.91	1.49	1.52	1.06		2.11	1.23
20.....		2.93	1.81	1.76	1.34	1.81	1.49	2.35	2.34	2.77	2.45	1.79	1.81	3.02	3.04	2.16	3.26	4.21	2.60
30.....		4.40	2.72	2.72	2.08	2.72	2.40	3.52	3.50	4.24	3.75	2.76	2.72	4.56	4.56	3.24	4.88	6.32	3.91
40.....		5.86		3.74	2.89	3.63	3.74	4.69	4.68	5.76	5.12	3.78							

eter Tests.

STEAM	TRUCKS				CLASS
	Speed M.P.H.	T	U	V	
1918			1919	 Car
2		4	4	4 Year—Model
4x5		3 $\frac{1}{2}$ x5	4 $\frac{1}{2}$ x4 $\frac{1}{2}$	4 $\frac{1}{2}$ x6 No. of Cylinders
		220	240	425.3 Bore and Stroke—Inches
20		22.5	27.0	38.0 Piston Displacement—Cu. Ins.
130		132	130	180.5 H.P. Rating
1,705		1,585	1,700	4,520 Wheel Base—Inches
2,215		1,880	1,760	6,625	Weight Lbs. on Wheels. { Front..... Rear..... Total.....
2,920		3,465	3,460	11,145	
35x4 $\frac{1}{2}$		35x5	34x4 $\frac{1}{2}$	36x5	
		F-N	F-N	S	Front Tires. { Size..... Type and Tread..... Infl'n Press.....
		90	75	Solid	
35x4 $\frac{1}{2}$		35x5	34x4 $\frac{1}{2}$	40.5	Rear Tires. { Size..... Type and Tread..... Infl'n Press.....
		F-N	F-N	S	
		90	75	Solid	
1.5		6.0	4.6	9.56 Gear Ratio
25.3		23	22	46.0 Frontal Area—Sq. Ft.
16,500		250		305 Miles Run to Date
20	10	31	26	83	Rolling Resistance { Front Wheels—Lbs.
20	20	31	26	83	
63	10	64	35	201	Rolling Resistance { Rear Wheels—Lbs.
63	20	64	36	212	
83	10	95	61	284	Rolling Resistance { Complete Car—Lb.
83	20	95	62	295	
7.6	10	7	6.6	13.8	Wind Resistance, Various Speeds, Lbs.
30.4	15	16		31	
68.4	20	28	26	56	
121.6	25	43			
27.6	10	38	32.6	96.8	Tractive Effort, Level Road, Lbs.
50.4	15	47		114	
88.4	20	59	52	139	
141.6	25	74			
763	10	413	300	1,009	Maximum Tractive Effort Direct Drive—Lbs.
367	15	400	322	870	
212	20	363	385	640	
143	25	315	360		
18.5	10	10.4	7.4	8.1	Maximum Grade Direct Drive—Per Cent.
7.8	15	9.8		6.7	
3.0	20	8.5	9.3	1.4	
	25	6.7			
0.74	10	1.01	0.87	2.58	Rear Wheel H.P. Level Road
2.70	15	1.90		4.55	
7.1	20	3.15	2.77	7.41	
15.1	25	4.90			
20.3	10	11.0	8.0	27.0	Rear Wheel H.P. Maximum Developed
19.6	15	16.0	12.8	34.8	
17.0	20	19.3	20.5	34.2	
15.3	25	21.0	24.0		
1.68	10	1.71	0.93	5.37	H.P. Lost—Transmission and Rear Tires
3.4	15	2.57	1.4	8.25	
5.0	20	3.42	1.92	11.30	
6.7	25	4.28	2.4		
2.42 ^a	10	2.72	1.80	7.95	Brake H.P. Required Level Road
6.1 ^a	15	4.47		12.80	
12.1 ^a	20	6.57	4.69	18.71	
21.8 ^a	25	9.2			
22 ^a	10	12.7	8.9	32.4	Brake H.P. Maximum Developed
22 ^a	15	18.6	14.2	43.1	
22 ^a	20	22.7	22.4	45.5	
22 ^a	25	25.3	26.4		
246 ^a	10	79	65.0	77	Brake M.E.P. at Maximum Load
123 ^a	15	78	69.0	68	
63 ^a	20	71	81.5	54	
62 ^a	25	63	77.0		
1.83 ^a	10	1.08	2.50	1.50	Fuel, Lbs. per B. H.P. Level Road
1.55 ^a	15	1.08		1.25	
1.35 ^a	20	1.08	1.48	1.13	
1.17 ^a	25				
	10	0.83	1.42	0.79	Fuel, Lbs. per B. H.P. Maximum Load
	15	0.83	1.34	0.81	
1.17 ^a	20	0.80	0.94	0.86	
1.17 ^a	25	0.83	0.75		
15.0	10	20.6	13.7	5.2	Miles per Gallon on Level Road
14.1	15	18.9		5.8	
12.2	20	17.1	17.7	5.8	
10.3	25				
	10	5.75	4.9	2.4	Miles per Gallon at Maximum Load
	15	5.9	4.9	2.6	
7.8	20	6.7	5.8	3.1	
10.2	25	7.25	7.8		

tion gears, propeller shaft and primary shaft of gearset, is in nearly all cases from 50 to 100 per cent higher than that of the front wheels, indicating that the friction of parts other than the tires is, in this case, a material factor. The divergence as between different cars is considerable, the resistance varying from a minimum of about 25 lb. to a maximum of 79 lb. in the case of pneumatic-tired vehicles. The weight of the rear wheels in these two cases was 1120 and 3000 lb. respectively, the resistance in pounds per ton being 44.7 in the first case and 52.7 in the second. In most cases the resistance is slightly higher at 40 m.p.h. than at lower speeds, but the difference is not great. Rolling resistance of the entire car is, of course, the sum of the resistance considered under the two preceding heads. That it varies materially as between various cars even of the same weight and tire equipment is at once evident from inspection of the tabulated data. A part of this difference is no doubt due to variations in adjustment and lubrication but it is a noteworthy fact that material differences do exist and that in many cases the cause could be easily remedied with considerable saving in power and fuel as well as in wear if the fault were more generally recognized.

If the rolling resistance figures are reduced to a comparative basis, that is expressed in pounds per ton, it will be found in most cases that cars equipped with cord tires have an average total rolling resistance of about 35 lb. per ton as against 50 or more lb. per ton with fabric tires. If we compare some rather extreme cases, say that of cars E and G in the same price class and weighing respectively 3390 and 2915 lb. both having 4-in. tires, the first cords and the second fabric type, we find that car E has a total rolling resistance of 51 lb. or 30.1 lb. per ton, while car G has a resistance of 75 lb. or 51.4 lb. per ton, an increase of over 70 per cent. In terms of power required for propulsion on a level road, wind resistance not included, the figures are respectively 2.72 and 4.0 hp. actual, or 1.6 and 2.74 hp. per ton at 20 m.p.h. At 40 m.p.h. the power required is twice as great. The differences may not seem material as compared to the maximum power capacity of the engine, but when it is realized that under the light loads involved the engines in question use 1.05 and 1.30 lb. of fuel per b. hp. respectively it is evident that the economy can be materially improved by avoiding unnecessary power losses.

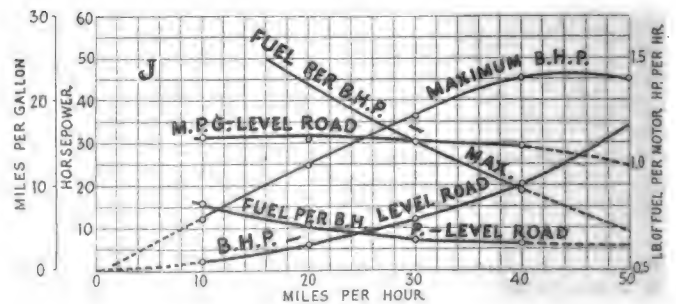
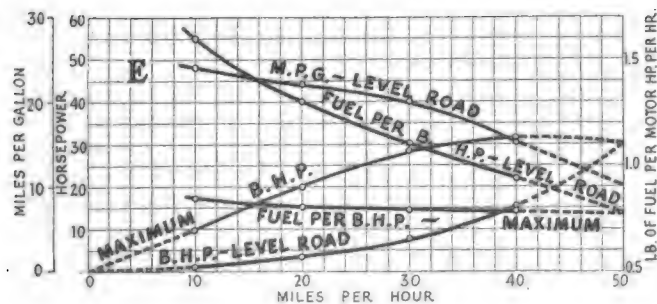
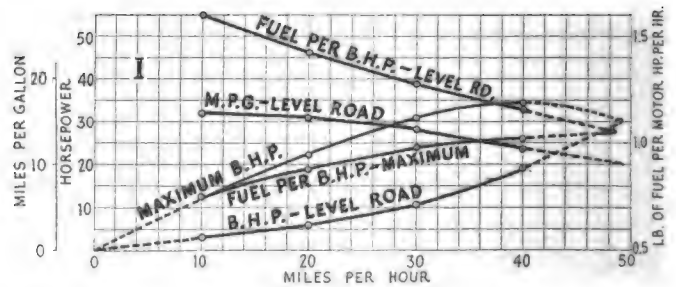
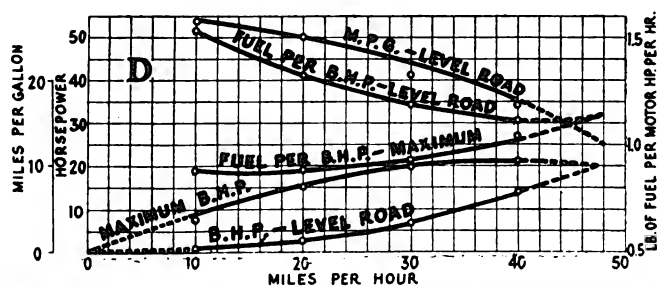
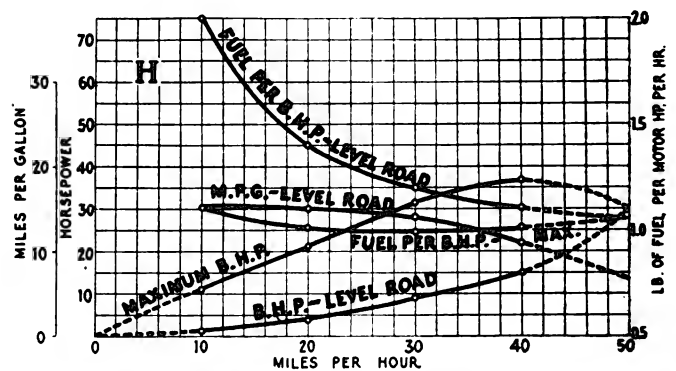
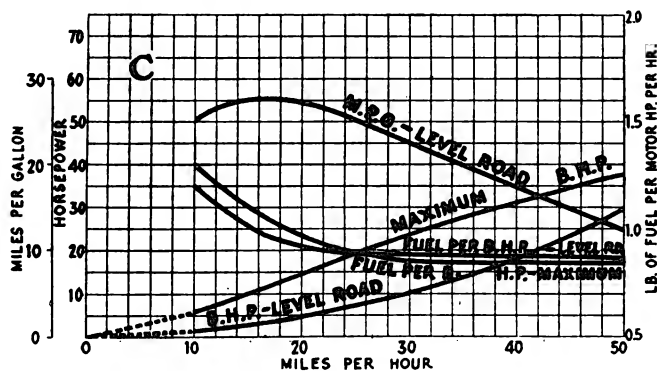
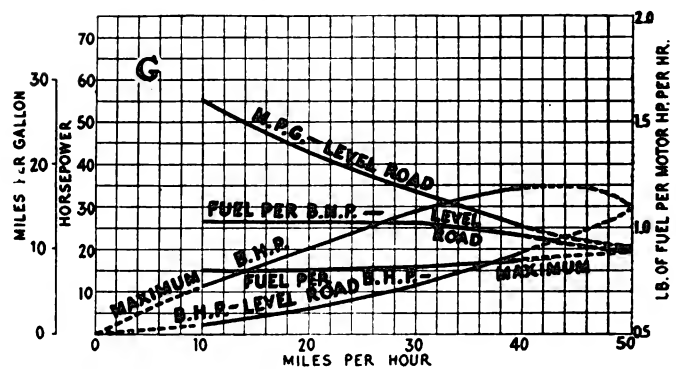
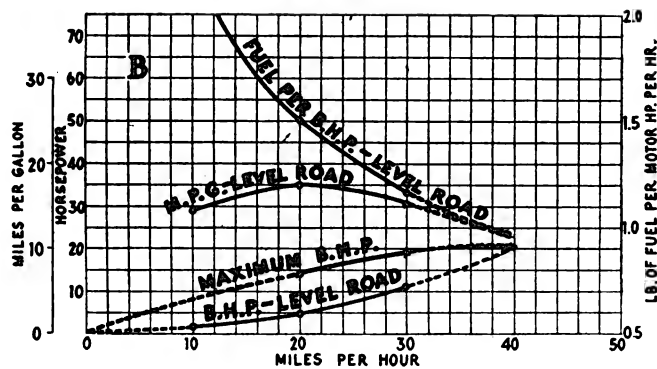
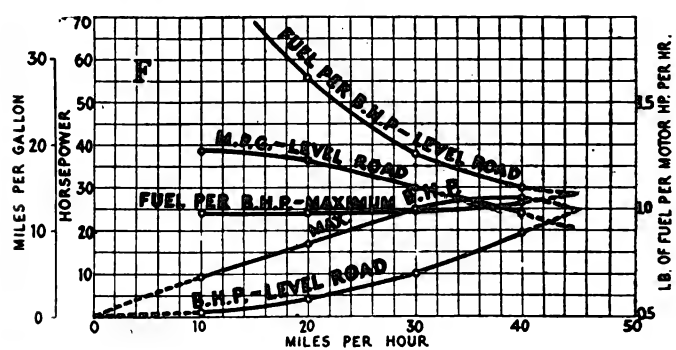
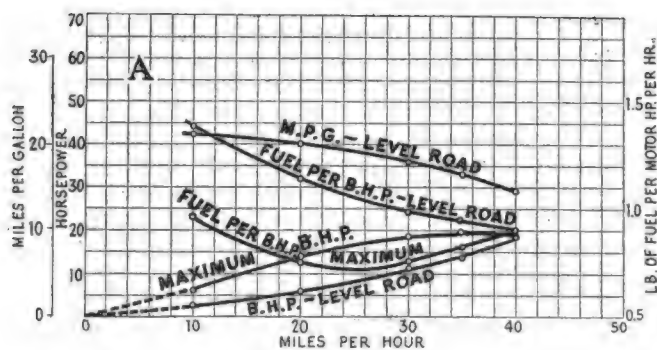
Wind Resistance and Tractive Effort

The figures on wind resistance in the table are computed, as already explained, by determining the projected frontal area of the car and multiplying the number of square feet by 0.003, the square of the speed in m.p.h. This, of course, is only an approximation, since the wind resistance is materially affected by the stream lines of the body, but it serves well enough for comparative purposes. According to the figures given frontal areas vary from 16 to 32.5 sq. ft. on the passenger cars listed. No doubt these areas could be decreased in some cases by improved body design, but precise methods of measuring wind resistance are needed before the effect of such changes can be predicted with certainty. It will be noted that the wind resistance becomes a factor of some importance even at speeds as low as 20 m.p.h. At higher speeds or when driving against the wind, the wind resistance, according to the method of figuring here employed, is shown to exceed in amount other level road resistance factors.

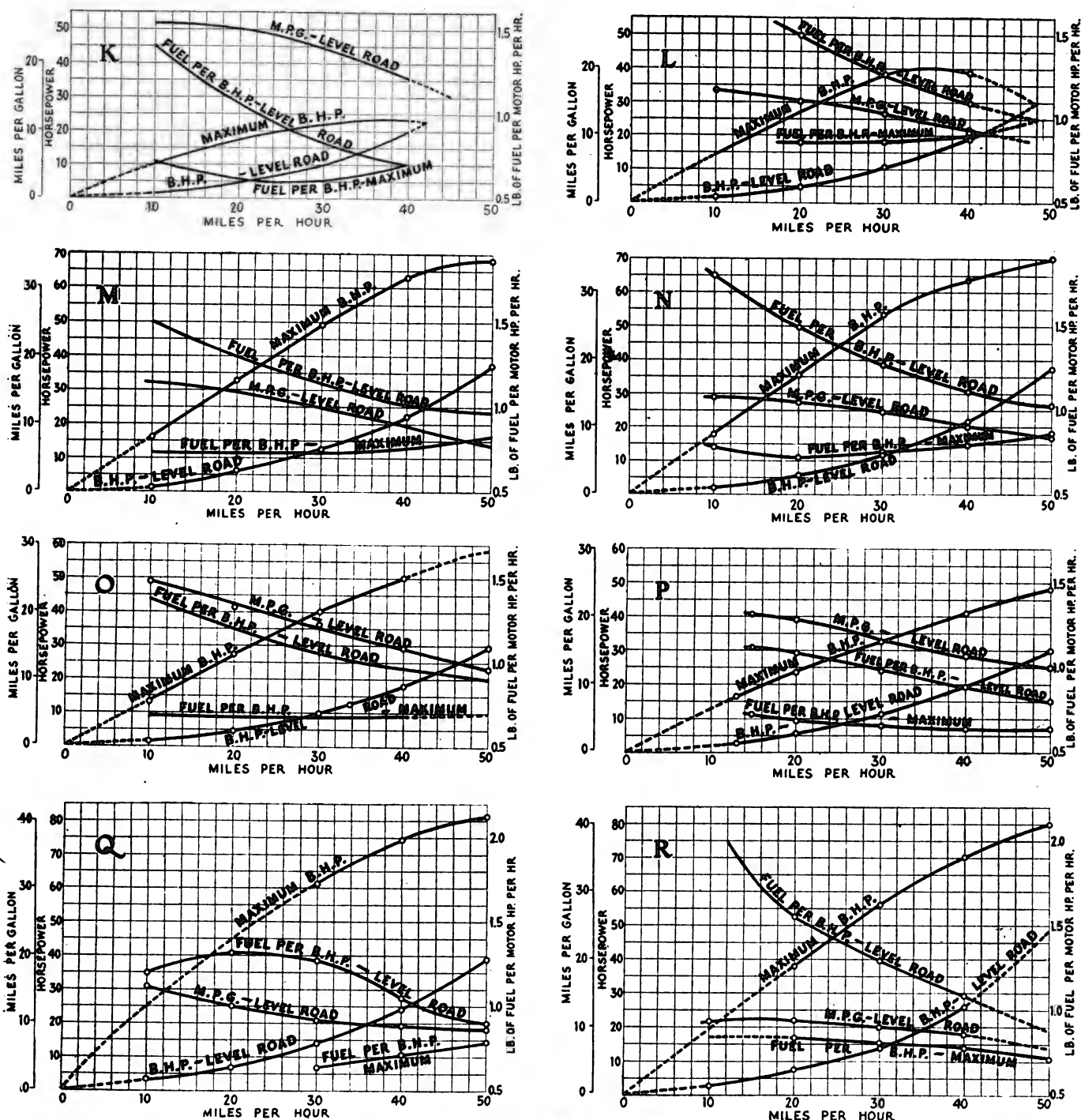
The figures in the column headed "tractive effort, level road," in the table are obtained by simply adding together the wind resistance and the front wheel resistance. This gives the pull which must be exerted at the periphery of the driving tires to propel the vehicle on a hard, level road at the various speeds indicated. In testing cars on

C—Cord.
N—Non-skid tread.

S—Smooth tread.
R—Ribbed tread.



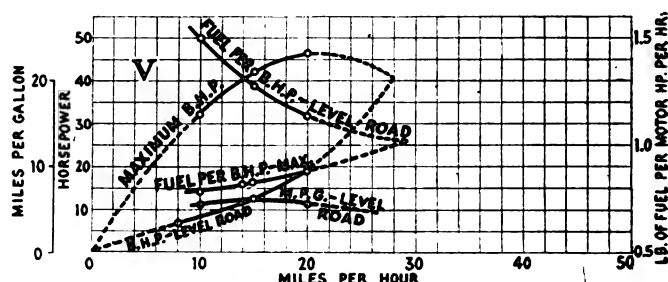
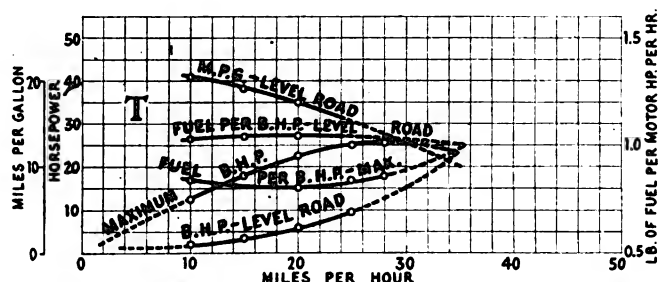
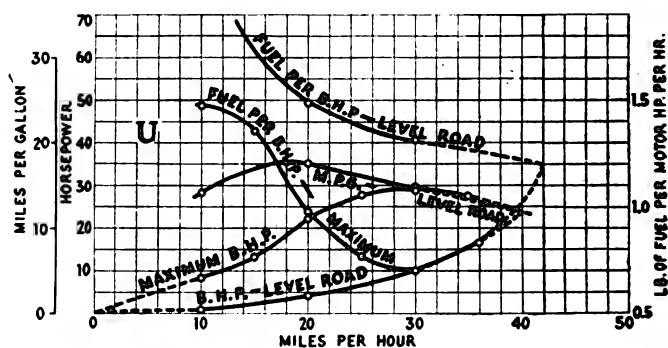
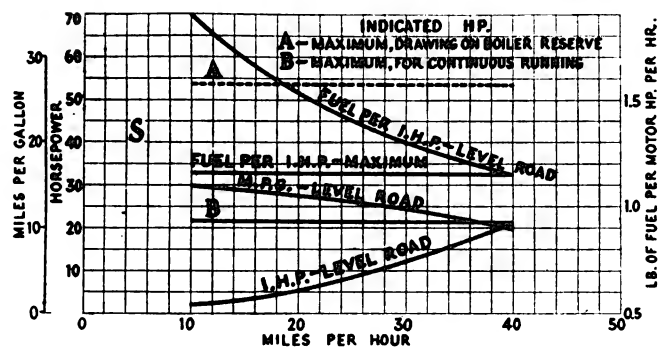
Performance curves of passenger cars A to J.



Performance curves of passenger cars K to R.

the dynamometer here described the brake is set to give a load equivalent to the tractive effort required for level road operation at the respective speeds, and the fuel consumption is then measured. The horsepower developed at the rim of the rear wheels under this condition is computed by simply multiplying the pull by the speed in m.p.h. and dividing by 375. The figures thus obtained are set down in the column headed "rear wheel hp. level road." In order to find the b.hp. required for level road operation it is necessary to add to the rear wheel hp. the loss in power between the engine and the road, including, of course, the power lost in the rear tires. This is assumed to be the same as the power consumed in the rolling resistance of the rear wheels and the parts driven by them when the gears are in neutral and is obtained by multiplying this rolling resistance in lbs. by the speed in m.p.h. and dividing by the constant 375.

That this is not a precisely correct method is probable, because the power loss when the gears are driving under load is presumably not the same as when they are running idle. It is doubtless true also that the tires consume a somewhat greater power when transmitting power than when rolling idle. Furthermore, when the engine is driving the car even on direct, the secondary shaft of the gearset is, in most cars, turning and consuming more or less power due to churning of the oil or grease in the gearset. When the wheels are driving the propeller shaft and the primary gearset shaft attached to it, the secondary shaft does not turn, hence the loss to this source is not included in the measurements of transmission losses here given. While this discrepancy is well recognized by Prof. Lockwood and his associates, it is probably not a very considerable factor in most instances, and can, therefore, be overlooked without great error. In any case the results



Curves showing the performance of the steam passenger car S, the light (gasoline engine driven) trucks T and U and the heavy "Class B" Army truck V.

here reported shed much light upon factors which are given far too little consideration by most automotive engineers and, therefore, serve a highly useful purpose, especially in the absence of more precise information on the various points in question.

The practice of making tests with loads substantially equivalent to those imposed upon the engine in level road operation is especially to be commended, for there is far too little data secured in general under these conditions which are the prevailing ones in service and therefore of great importance. Consequently, while it is readily admitted that the tests do not precisely duplicate the conditions of level road operation, they do closely approximate them and are far better than any arbitrary selection of load which may or may not be indicative of usual service conditions.

It is interesting to note from the tabulated data that the rear wheel hp. for level road operation at 20 m.p.h. is in most cases well under 3 hp., the minimum figure recorded is 2.29 and the maximum for a passenger car 4.03 hp., the latter applying to a car which weighs 5180 lb. The rear wheel hp. for level road operation increases at a higher rate than the speed due to the factor of wind resistance, which increases as the square of the speed. It is a significant fact that at 20 m.p.h. the rear wheel hp. required for level road operation is only 20 or 25 per cent of the maximum available, while with some of the larger cars it is only 10 per cent of the maximum available. This, of course, means that the car has a very low average power factor, and, since the economy of throttling engines of the conventional type is low at low loads, the engine operates most of the time under loads at which its thermal efficiency is poor.

The maximum tractive effort which the cars tested are capable of developing when running in direct drive is of interest chiefly as indicating the reserve power which American cars have for hill climbing and rapid acceleration. The advantage of this quality is appreciated by the user insofar as it affects performance to a marked degree, but the adverse effect upon the fuel economy which is involved in the use of large gear reductions and consequent high engine speed with its accompanying excessive friction loss and average operation under low throttle conditions is seldom fully appreciated.

The maximum grade (expressed in per cent) which the

car will climb in high gear at the various speeds is determined readily by dividing the net tractive effort, or the maximum tractive effort minus the tractive effort for level road operation, by the weight of the car plus whatever load it carries. In the figures here given the weight of the driver only is added to that of the car in computing maximum grade which the car will climb on direct drive. Since acceleration is equal to the force acting divided by the mass of the body whose velocity is changed, the accelerating ability of the car is easily computed by dividing the net tractive force by the weight of the car plus the load it is carrying, and multiplying by g , the acceleration of gravity. Accelerating ability varies with the speed, just as the grade which the car can climb varies, both becoming zero at the maximum level road speed which the vehicle is capable of attaining.

Brake Horsepower of the Engine

The brake horsepower which the engine is required to develop for level road operation at average driving speeds is small as compared to its maximum power at these speeds. The average at 20 m.p.h. for 17 passenger cars is about 5.4 hp. as against a maximum hp. average at the same speed of 23.8. In other words, under what may be considered a normal operating condition, the average engine develops from one-fifth to one-quarter of the power it is capable of developing at that speed. Even the heaviest of the passenger cars tested requires only 7.55 b.hp. to propel it at 20 m.p.h. on a level road while some of the lighter cars require only a little over 4 b.hp. Were facts such as these more generally appreciated, it seems almost incredible that so little attention would have been given to making engines which are more efficient at the light loads obtained in normal use.

It is instructive to note from Table II, which is condensed from Table I but contains some additional computations, the relative importance of the three losses which together exactly balance the power developed at the flywheel of the engine. These are (1) the rolling resistance of the front wheels, (2) the power losses between the engine and the driving surface of the rear tires, including the losses in these tires and (3) the wind resistance. It will be seen that (1) varies from 20.2 to 30.8 per cent of the total, the average being nearly 27 per cent. Item (2) accounts for an average of 46 per cent, varying

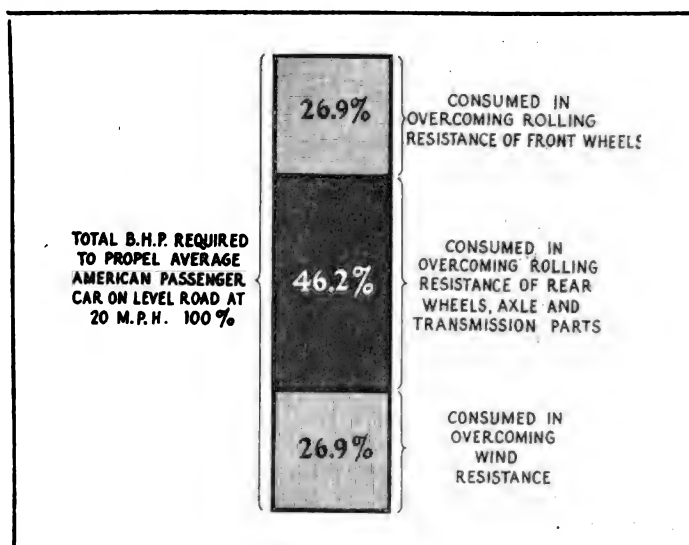
from 37.5 to 55.7 per cent of the total, while item (3) averages the same as (1) but varies from 19.5 to 37.8 per cent of the total. These figures apply to a speed of 20 m.p.h. on a level road, with no head wind. At other speeds and loads the factors vary, the windage in particular increasing rapidly with increase in speed.

If it is assumed that the rolling resistance of the rear tires alone is the same as that of the front tires the remaining power losses attributable to friction of mechanical parts, including the gearing in the axle and the bearings plus the losses caused by any churning action on lubricants amounts to about 20 per cent of the total brake power developed by the engine. Tire losses alone probably amount to about half of the total under the conditions in question, and these losses are minimized when a good grade of cord tire properly inflated is used. That there is a large variation both in the amount and percentage of the various losses is at once evident, but the reason for the variations are not apparent from the data in hand. It is probably fair to assume, however, that the higher figures can be bettered in most cases if a more detailed analysis of the reasons for the loss were made. In comparing the figures for different cars it should be borne in mind that rolling resistance usually increases with increase in weight, other things being equal. Evidently other things are not equal in some of the cases recorded. Probably the variation in tire equipment accounts for a considerable part of the difference in some instances.

Efficiency of Power Transmission

If we accept as correct for conditions of power transmission the power losses recorded we find that the ratio of power delivered at the periphery of the driving tires to the brake power developed by the engine, or what may be termed the efficiency of the drive is 0.89 to 1 in the average case for passenger cars running under wide-open throttle at 20 m.p.h. The variation under this condition is from 78.5 to 93.2 per cent. The reasons for believing that the power losses are somewhat greater when the transmission system is running under load rather than running idle, as it was when the power losses here given were measured, have already been stated.

There is little doubt that the tires are much the largest single source of power loss in the transmission, even though they be of the cord type. For this reason such relatively slight difference as may be caused by differences in the bevel gears are probably not of great importance in the total, although it is quite conceivable that a change in the type of gearing employed might have a marked effect. It should not be forgotten, however, that the total loss in the mechanical parts other than the tires is quite considerable, as already pointed out, so that each of these losses



should be minimized in the interest of high over-all efficiency.

Fuel Economy at Various Loads

Coming now to the matter of fuel consumption, we find, as anticipated, that the rate at which fuel is used per b.h.p. at the light loads of average normal use is very much greater than at full load. The average consumption of 17 of the passenger cars listed is 0.80 lb. per b.h.p.-hr. at wide-open throttle and a speed of 20 m.p.h., the maximum and minimum figures for the same conditions being respectively 1.04 and 0.66 lb. With the engine operating under level road conditions and at the same speed the average consumption of the same 17 cars is 1.34 lb. per b.h.p.-hr., or nearly 70 per cent higher than at full load. The maximum and minimum figures under this condition are respectively 1.80 and 0.97 lb. From curves given in the accompanying charts it is apparent that in most cases the engine operates most efficiently when running under wide-open throttle at speeds corresponding to 20 or 30 m.p.h. on the road, a condition of operation which obtains, in all probability, much less than 1 per cent of the time the car is in actual operation. Under the conditions of average normal operation, on the other hand, the thermal efficiency averages little more than half that obtainable under the comparatively unusual condition of wide-open throttle. Such a condition would not be tolerated in the operation of any other class of powerplant in extensive

Table II.—Showing Brake Horsepower Required to Propel Car on Level Road at 20 M.P.H. and the Various Factors Responsible for Consumption of This Power

Car	A Per Cent Fabric		C Per Cent Cord and Fab.		E Per Cent Cord		G Per Cent Fabric		I Per Cent Fabric		K Per Cent Cord		Q Per Cent Cord		Average Per Cent
Type of Tires.....	Hp.	Per Cent	Hp.	Per Cent	Hp.	Per Cent	Hp.	Per Cent	Hp.	Per Cent	Hp.	Per Cent	Hp.	Per Cent	
Hp. Consumed in Overcoming Front Wheel Rolling Resistance	1.09	20.2	1.65	35.2	0.91	22.5	1.65	30.8	1.71	30.4	1.15	24.4	1.87	24.8	26.9
Hp. Consumed in Overcoming Rolling Resistance of Rear Wheels, Axle and Transmission Parts	2.93*	54.2	1.76	37.5	1.81	44.7	2.35	43.7	2.77	49.2	1.79	37.8	4.21	55.7	46.2
Hp. Consumed in Overcoming Wind Resistance	1.39	25.6	1.28	27.3	1.33	32.8	1.37	25.5	1.15	20.4	1.79	37.8	1.47	19.5	26.9
Total = B. Hp. Required to Propel Car on Level Roads	5.41*	100.0	4.69	100.0	4.05	100.0	5.37	100.0	5.63	100.0	4.73	100.0	7.55	100.0	100.0

*Has planetary gearset which produces undue friction when rear wheels are driven with gear shift lever in neutral position.

use. Most powerplants are designed to give, so far as possible, their maximum economy under the conditions for which they are most used. Not so the motor car engine. There are many reasons for this condition, among them being a more or less general lack of understanding of the conditions of average performance and of steps which can and should be taken to increase economy under these conditions.

It will be noted that the number of miles per gallon which a car will travel decreases as a rule with increase in speed. This is due, of course, to the fact that the power required for propulsion is less at the lower loads, although the thermal efficiency at these speeds is much less. It is evident, however, that, since a certain power is necessary to propel a vehicle at any given speed, the engine which develops this power with the least expenditure of fuel per hp. is the one which will propel the car at that speed the greatest number of miles per gallon of fuel consumed. If it were feasible to design the car so that the engine, which is usually most efficient at full load, could operate at full load under normal speed and level road conditions, it would, of course, go much further per gallon than at present. Since this is not feasible, it is desirable to strive to make the engine as economical at low as at high loads. This is a difficult problem, but steps in the right direction are being made and should receive more encouragement than they are generally given at the present time.

Performance of Steam Car and Trucks

Much of the foregoing analysis applies primarily to the passenger cars A to R inclusive as listed in Table I, but most of the points brought out apply also to the light trucks T and U and many of them to the steam-driven passenger car S and the heavy Class B army truck V, although certain of the data in reference to the last two vehicles mentioned are, for obvious reasons, quite different than that covering the passenger cars of the usual type.

Since in the steam car the engine is geared directly to the rear axle—that is, drives the axle without a clutch between the two—the friction of the engine is included in the rolling resistance of the rear wheels, and the power of the engine is the indicated instead of the brake power, the latter being obtainable by the usual method employed in other cases. The fuel measurements are also based on indicated power. The data covering the indicated m.e.p. of the steam engine, while not directly comparable to the brake m.e.p. given for engines in the other cars, shows immediately why steam cars do not require the use of a gear-set such as is employed in the conventional gas car and truck.

The standard Class B army truck is much the heaviest of the cars tested and the only one equipped with solid tires. It will be noted that the rolling resistance of the front wheels at 20 m.p.h. is 83 lb. or 36.7 lb. per ton as compared to 30.2 lb. per ton for the largest cord tire on the passenger cars. Corresponding figures for rolling resistance of rear wheels is 212 lb. total or 64 lb. per ton as against 52.7 lb. per ton, the figure for the passenger car having the highest rear wheel rolling resistance. The rear wheel hp. required to propel the truck at 20 m.p.h. is 7.41 or 1.33 hp. per ton as compared to 4.03 hp. or 1.56 hp. per ton for that passenger car which required the largest amount of rear wheel hp. at the same speed of all those tested. For the truck the b.hp. required for level road propulsion at 20 m.p.h. was 18.71 or 3.36 b.hp. per ton as compared to 7.55 b.hp. or 2.85 b.hp. per ton for the heaviest passenger car tested. The ratio of the power delivered at the rear wheels to brake power developed by the engine under wide throttle conditions is 34.2 to 45.5 showing that the efficiency of power transmission (rear tire losses included) is only 75 per cent, or lower than that of any of the passenger cars. The maximum miles per gallon recorded for the truck in question was 5.8, or 32.3 ton m.p.g. approximately the same as the equivalent reading for the heaviest passenger car.

Cutting Fluids

TECHNOLOGIC PAPER NO. 204 of the Bureau of Standards on the subject of cutting fluids will soon be available for distribution by the Government Printing Office.

The paper is divided into two parts, theory and practice. In the first part the difficulties attending the proper lubrication of the cutting tool in machine work are described, and the reasons why lard oil is particularly suitable for this work are set forth. It is shown that the viscosity of an oil is not the only factor to be considered in this connection. Oils for cutting purposes should have a high adhesion, and it seems possible to improve mineral oils by adding such fluids as oleic acid, pine oil and fixed oil.

An important function of cutting fluids is to cool the tool and chip, and for this purpose alone water with its high specific heat is well suited, but it rusts the machines, and for this reason where water is used such alkaline substances as soda or soap are always added. In conclusion, Part 1 suggests methods for the measurement of the adhesion of oils.

Part 2, practice, considers the correspondence which the Bureau conducted with many large machine shops throughout the country as to their experience with cutting fluids. The different kinds of oils which have been used for this purpose are listed, and attention is given to the possibility of using emulsions made up of mineral oil compounded with neutralized sulfonated oil and formed into a permanent emulsion with water.

Mineral oils compounded with alcoholic solutions of soap and a thick soap solution and mineral oil marketed as a paste, are also described. In choosing any cutting fluid it is pointed out that the character of the metal to be worked should be considered. Brittle metals, such as cast iron, are easier to lubricate than the so-called "draggy" metals, such as soft steel and wrought iron.

Porto Rican Market Opening Up

THE head of the largest automotive business in Porto Rico, who was in New York recently, declared that business is on the upgrade again in that country and that it should again be considered in the buying column. No stocks of new cars are on hand, and orders are being placed rapidly. The new sugar crop will soon be coming in, and automobiles are needed to take care of transportation needs not provided by the railroads. The railroad services in Porto Rico are poor but the highways are good. Hundreds of motor buses are already in operation and the use of trucks is growing.

A CATALOGUE of the Mechanical Engineering Collection in the United States National Museum has recently been compiled by the Smithsonian Institution in the form of Bulletin No. 19 of the Museum, and can be obtained from the Superintendent of Documents, Government Printing Office, Washington.

An Efficient Method of Transmission Production

Methods employed in the Hudson and Essex Transmission Department. Drilling of cases and machining of gear blanks accomplished by labor saving methods. Gears matched for best mesh by a special testing device.

By J. Edward Schipper

AN interesting example of what can be done in efficient production is offered by the transmission departments of the Hudson and Essex companies. Transmission units were formerly made in separate departments, and there were a number of breaks in the continuity of manufacturing progression. By bringing the two transmission jobs into one department, the cost of manufacture, as compared with that of a year ago, has been cut at least 40 per cent. The departmental overhead has been practically cut in half by a rearrangement of the machines and by better placing of the workmen; the labor cost has been reduced 25 to 30 per cent and the manufacturing operations on the two types of transmission require only little more than the floor area formerly required for one. The work in this department is handled on the group system, in accordance with the general practice in the Hudson factory.

An idea of the efficient operation of the department may be gained from the fact that 75 cases for the Hudson car, each requiring 24 operations, have been put through daily by six men during the time of curtailed production. Now that production is increasing rapidly, practically the same ratio of operators is being maintained, indicating a highly efficient arrangement of machinery and the use of types of machines, which, in a great many instances, are so nearly automatic that three and sometimes four machines can be taken care of by one operator.

The way the transmission department is at present laid out, it can take care of 150 Hudson and 150 Essex cases per day. The machining operations on the two types of case are practically identical in character, although the dimensions of the case and some of the details differ. The machining operations run along parallel lines and the work supervision is taken care of by one staff instead of two, which has been a material factor in the reduction of overhead. An outline of the methods employed in manufacturing the transmission case is of interest.

The cases are of aluminum and are checked in the receiving room on a target, to make sure that there is sufficient metal at all points for the initial cuts. Location on this target is by two V-blocks on the countershaft bearing at both ends of the case. This same method of location is employed for the first operation on the case, which is milling the top face (Fig. 1). Two cuts are taken off the top face on a Cincinnati miller, the first being a rough cut, $\frac{1}{8}$ in. deep, and the second a finish cut in which only about $\frac{1}{64}$ in. of metal is removed from the top face.

Using the milled face as a location with V-blocks on

the two countershaft bearings, the main and countershaft bearings are rough and finish bored. Both sides of the transmission case are worked on simultaneously by means of four tools (Fig. 2). The rough and finish cuts are taken on the same machine. The first tool to enter takes the rough cut, and as soon as this is clear of the hole the finishing tool takes up the work. The work is handled on a Barnes double-head, horizontal boring mill, and 0.004 in. is left for finish reaming both bores.

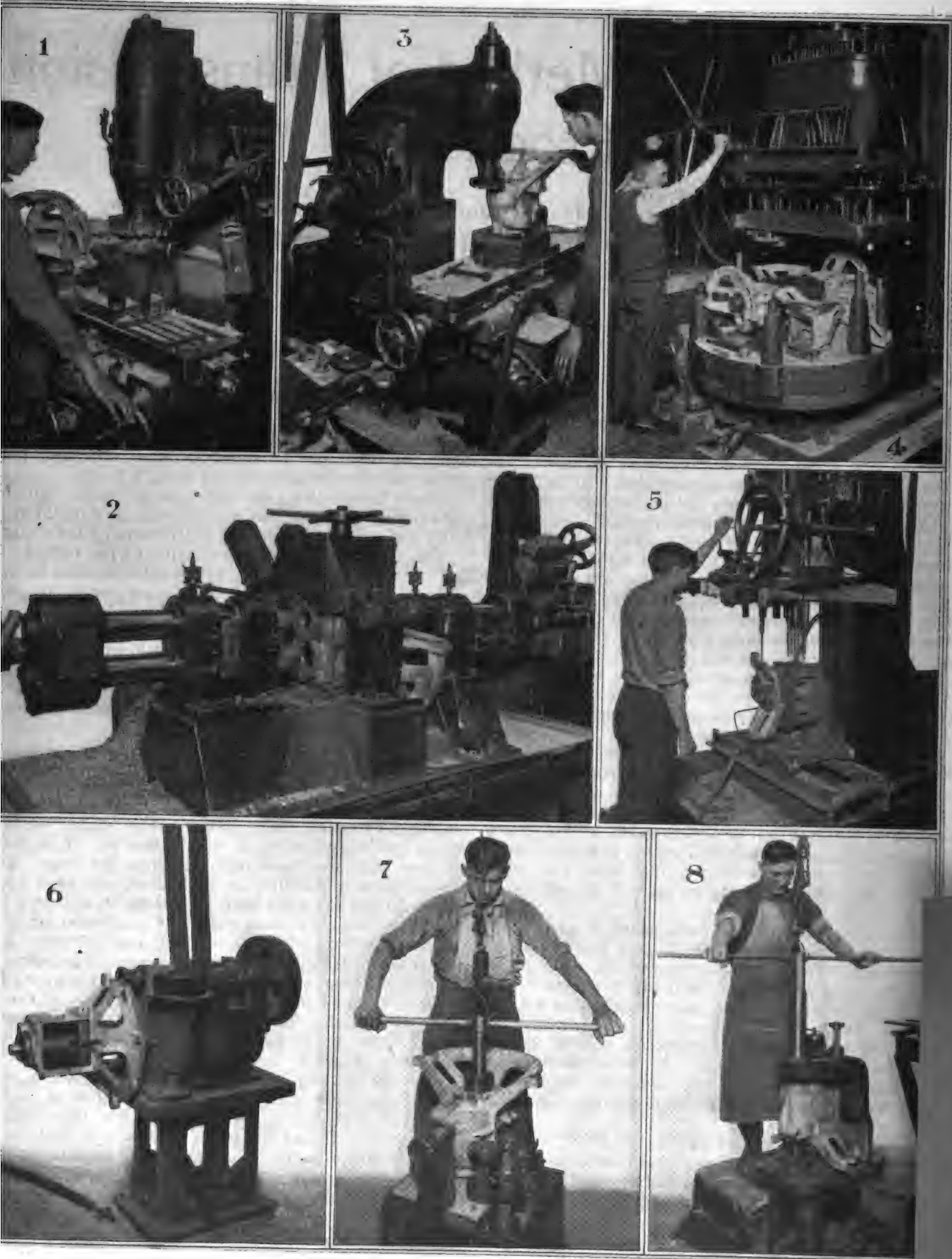
The front end of the case inside of the bell is faced off in the next operation. The work is located from the rear end face, lengthwise, and transversely by means of an arbor which passes through the main bore. This operation of facing off the front end fixes the length of the case. The work is done on a Baker mill. Following this operation, there is another milling job on the pedal bosses, this work also being located from the rear end and on the arbor through the main bore. This latter work is done on a Steptoe mill.

Nearly all the drilling on the case is done at one time on the ingenious Natco multiple spindle installation, Fig. 4. This machine works on different sides of three different cases at the same time, and, having an indexing table, permits of three others being loaded while the three are being worked upon. In this way it is possible to pass 60 cases through the machine per hour. Twenty-six holes are drilled in each case, and they are all located from the main bore. Formerly it required three machines to do this same work, and a material cut in cost has been made, as there is now only one operator. There are other drilling operations which cannot be taken care of on the Natco; one of these is handled by a Baush drill, which performs two operations on two sides of the case with an indexing fixture. The holes drilled are for the pedal bolts, brake ratchets, anchor pins and oil level indicator (Fig. 5).

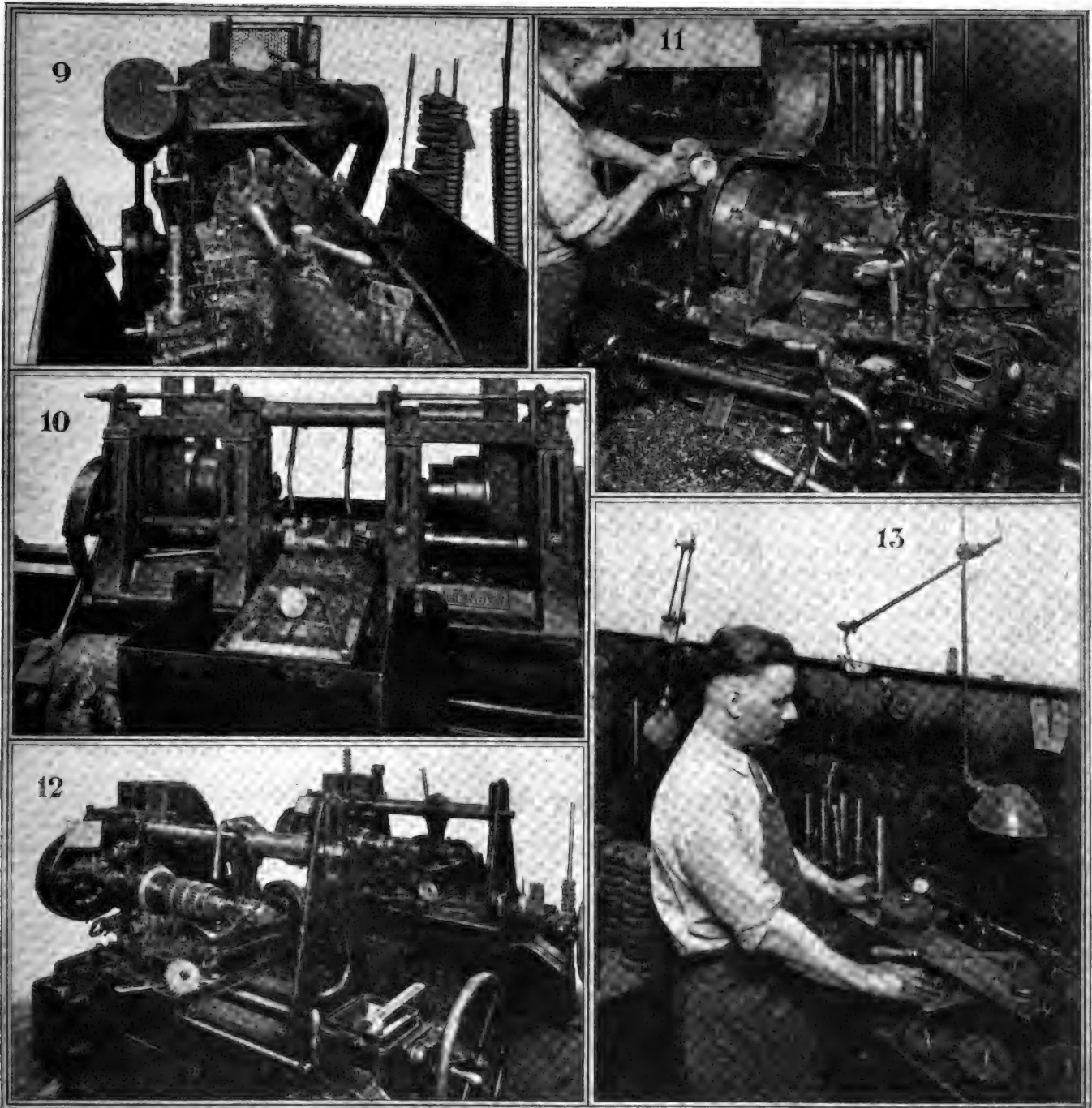
Another drilling operation is for the oil return, which is on an angle and consequently requires a separate operation. A Carlton radial is used for this work and also for spot facing the brake ratchet boss and for tapping the holes in the boss and the oil level holes. This same machine also drills, spot faces and taps the drain plug holes at the bottom of the transmission case.

Both ends are tapped on a Carlton radial with a reversing fixture, and a similar machine taps the top face flange holes and the brake pedal holes. Finish reaming of the main bore is a hand operation of line reaming.

In finish milling the bell flange (Fig. 6), the case is located on an arbor through the main bore, with the front face resting against a shoulder on the arbor. The distance from this holder fixes the length from the front



1—Initial milling operation on top face of Hudson transmission gearcase. Machine takes rough and finish cuts. 2—Rough and finish boring main and countershaft bearing bores on one machine, boring from both ends simultaneously. 3—Milling front end of gearcase on a Baker mill, fixing length of case. 4—Natco multiple spindle drill Hudson transmission case for oil level hole and pedal control bracket hole. Capacity 1 per min. 5—Drilling secured by the arbor through the main bore. 6—Finish reaming main shaft bore. This is a hand operation for best possible finish. 7—Finish reaming the transmission countershaft bore. Note fixture, which pilots above and below the reamed hole. 8—Finish reaming the transmission countershaft bore. Note fixture, which pilots above and below the reamed hole.



9—Turning two sides and face of the transmission main shaft drive gear simultaneously on an automatic lathe. 10—Straddle milling to length transmission main shaft drive gear. 11—Pratt & Whitney machine which rough and finish turns the main shaft drive gear bore for the internal bearing, turns relief and chamfers. Note steady rest on machine on each side of chuck. 12—Rough cutting six main shaft gears simultaneously on a Barber-Colman hobbing machine. Teeth are finished on Fellows shapers. 13—Rolling and matching gears for transmission gearset before sending them to final assemblies

face to the front of the bell. With the case in practically a finished condition, the bell housing is drilled and reamed for the dowel pin holes, which locates the bell housing against the dowels on the crankcase. Location for drilling these dowel holes is from the main bore and from a dowel through the center bell housing bolt hole. The location being primarily from the main bore, alignment of the transmission housing with the center line of the crankshaft is assured.

The final operations on the case are spot-facing the bosses on the bell flange, drilling, reaming and spot-facing inside and outside with a combination tool, the reverse idler shaft hole, and then finish reaming the countershaft bore. A feature of interest in connection with

the reamer used for the countershaft bore is that pads are placed on the reamer acting as bearing surfaces, giving chip clearance which would not be available with a solid type of reamer. In order to secure the utmost accuracy in this final reaming operation (Fig. 8), the reamer shaft pilots above and below the reamed hole and is held to very close limits. This finishes the case, which is then washed in sal soda and passed along to the assembly line.

Manufacture of the transmission gearcases is backed up by a very efficient gear department. The forgings are bought outside, but all of the machining and forming is done in the Hudson-Essex transmission department. In the initial operation for the forming of the blanks,

each man finishes his own gear blanks; that is, he drills them, round-broaches them and key-broaches them. The drilling is done on Foote-Burt drills and the broaching both for the round-broach and the key-broach, on La Pointe broaches. In this little department for the manufacture of the blanks, five men can turn out 1700 to 1800 gears per day. These blanks are turned over to the gear department, the gears, regardless of size, going through quite similar operations. The first operation, ordinarily, on any of the gears is done on Potter & Johnson automatics. In this operation three faces are turned at once (Fig. 9). The machine turns both sides and the outside diameter. These Potter & Johnson lathes are so lined up that one man can take care of four machines. The machines turn out about 12 per hour, giving a production of 48 per hour per man on this particular job.

The Essex countershaft has an integral gear. This is straddle milled to length on a Hendey duplex mill (Fig. 10.) The countershaft is centered at both ends on a De Whiton centering machine and is then turned over to a Fay automatic which rough and finish turns the countershaft on the same machine. In this work the countershaft is located between the centers, and all four diameters on the shaft are turned in this operation. The key-way is cut in this shaft on a Cleveland machine which has been rigged up with a weight on the end of the feed lever to permit the operator to take care of two machines. Without this it is would be necessary for him to press on the feed lever to feed the saw to the proper depth. A trip is arranged in connection with the weight so that the proper depth will not be exceeded.

The second operation on the main drive gear is performed on the Pratt & Whitney machine, which rough and finish turns the gear, bores for the pilot bearing,

turns the relief and chamfers. This machine, which is illustrated in Fig. 11, is designed for accurate production and is equipped with a steady rest, as shown, to prevent chatter of the tools. Following the automatic operation, the main shaft drive gear is ground for two bearings. It is also ground for the internal bore, location for the latter operation being from the outside ground surface. There is a bushing on the fixture which locates around the external grind.

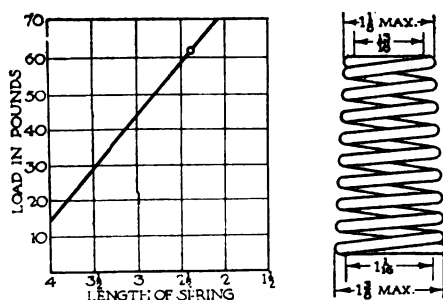
The gear teeth are rough cut on the Barber-Colman hobbing machine. One man takes care of four of these machines and on some of the gears six can be roughed out at a time by placing them face to face (Fig. 12). One of those gears, of which six can be roughed out at once, is the countershaft constant mesh gear for the Essex. The gear teeth are finished on Fellows shapers.

Before the gears are sent to the transmission assembly department, they are matched up for the best mesh. Different gears are tried out on a special fixture with an amplifying gage and adjustable center distance, and those which match with the least "run-out" are selected to run together (Fig. 13). They are held to 0.002 in. eccentricity and are not permitted to have a "run-out" between the gears of more than 0.004 in. at any point. After this selection has been made the gears are passed along and meet the cases at the point where assembly takes place. The assembly is progressive and the line is equipped to handle either Essex or Hudson transmissions. As production is being increased rapidly at the plant, the figures here given are somewhat out of date, but give an idea of the ratio of men to assemble cases. At the time the notations were made, six men were assembling 120 cases per day, or an average of 20 transmission gear-sets to the man per day.

Specifications for Valve Springs

AN interesting point which may have come to the attention of engineers and purchasing agents is that where valve springs are specified simply by the amount of compression for 60 lb. pressure or for any other figure which may be given, considerable variation has been experienced in the bids made by the different concerns on these springs. The reason for this is that it is possible to make up the valve spring with fewer turns and with other variations so that it is perfectly possible to meet

graph is plotted for the range from 15 to 70 lb., which increase in pressure causes the spring to compress from 4 to 2 in. in length.



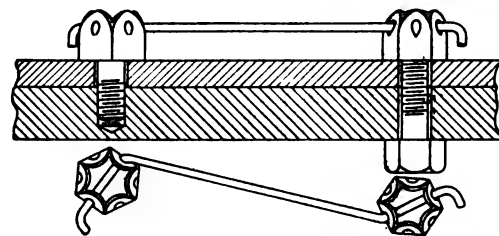
Compression charts for spring specifications

the compression specification with springs varying considerably in other respects.

A Detroit manufacturer specifies coil springs by the use of a graph of compression per pound load. The drawing for the spring, instead of merely carrying the dimensions of the spring with load specifications, also include one of these graphs or charts of compression. A sample drawing for a valve spring is illustrated herewith. It will be noted that the pressure-compression

Crown Socket Screw and Nut Lock

A VERY simple device for locking nuts and screws against unscrewing has been placed on the market by C. E. Ashley. It consists of a hexagonal socket-shaped stamping with its six sides turned up and perforated near



Crown screw and nut locking device

the top. The lock is placed under the nut or bolt head and after the latter is screwed home a wire is drawn through the holes in two of the sides of the socket. This wire, which also extends through holes on similar adjacent locking sockets, prevents the nut or screw from unscrewing. It would seem that the locking device is particularly applicable in cases where there are a number of screws or bolts close together, as in the covers of machinery cases, but can of course be used also with a single bolt, as a place to secure the wire to can practically always be found, and if not, can be provided.

Business Revival Evidenced by Specific Reports

All sections of the country appear to be sharing to a greater or lesser degree in the general revival of business. Increase partly seasonal but specific reports show an acceleration and improvement in all automotive lines which may be taken as indicating a more or less permanent condition.

FOR some time we have had indications that the automotive business is picking up; this improvement has been somewhat localized and hence not realized as being indicative of a general business revival. However, as these welcome signs have increased in number, they have lost their character of localization and have become indicative of fact rather than hopes.

Reports which come in from all over the country show that the industry has a great deal of sound business to look forward to. These reports give word of a factory taking on employees here, of heavy travel there, of an increase in orders and of definite increases in sales generally. The fact that they report hopeful signs from such a number of places and concerns changes the character of the items from one of rumor and hope to one of concrete fact.

The various news items which follow will indicate clearly the fact that business is proceeding well and that it is general throughout the country. Such items will doubtless be of more value and interest than a general statement of conditions because they do, in many cases, give specific facts which carry with them a certain amount of proof.

Middle West

Detroit.—Business conditions throughout the Middle West and Southwest are showing a decided change for the better, and this is having a strong tendency to improve the motor truck business, according to Vance H. Day, sales manager of the General Motors Truck Co., after an extensive trip through this territory. Cities visited included Chicago, St. Louis, New Orleans, Houston, Dallas, Salt Lake City, Lincoln, Denver and Kansas City.

Most of this business is coming from the industrial centers, he said, the farmers being responsible only for a small part of it. There are indications of strong business from the agricultural districts late in the summer, but this depends largely on the prices the farmer is able to command for his products.

The greater part of the business is for lighter model trucks, Day said. Buying in the heavy duty vehicles is light. The company will manufacture 1000 vehicles in April, and the May and June schedules are expected to be as heavy.

The company is making preparations for marketing its new bus which is now in production.

Minneapolis.—Dealers are making actual deliveries and one large distributor is several hundred cars behind orders at the factory. These are cars that are actually sold. While trainload delivery of cars to this territory has not been resumed, business is tending that way. One firm delivered 68 cars last week and has

started in well this week. There is some trading in, but a lot is straight business.

In spots the bankers seem to be relenting and permitting dealers to get money to bring in cars, but sales to date seem to be among people who have had money but delayed buying of cars until spring.

Reports by travelers back from Montana on business trips carry the inference that there is much better feeling. With two copper mines resumed at Butte and between 6000 and 8000 men again at work, wool selling higher and a good crop planting outlook the financial feeling is better.

In general prices in the Federal banking district have risen for all grains except rye and all live stock except cows. Wool prices and sheep are strong in this advance. Wholesale trade is increasing as well as flour grinding.

Unemployment has decreased generally, crop acreage prospects are better, merchandise distribution has increased and there are fewer business failures. A survey by a St. Paul newspaper divulges the fact that less than 40 per cent of the farms in the Northwest outside Wisconsin are mortgaged. In Minnesota 60 per cent of the farms are free from debt, in North Dakota 61 per cent, in Montana 55 per cent and in South Dakota 45 per cent.

Moline, Ill.—Velie Motors Corp. will probably increase its daily output from 25 to 45 in the near future, due to the gain in demand.

"Our Cedar Rapids and Waterloo, Iowa, dealer reports that more farmers have been looking at cars in the last two months than in the ten preceding months," said H. T. Wheelock, advertising manager, in speaking of agricultural conditions. "Our Fort Dodge dealer points to banks in his city which have paid off their entire Federal Reserve indebtedness as indication of improvement in business and states that the automobile trade is reflecting this condition. Fifty per cent of the Iowa farmers are able to buy cars at the present time, and the outlook for the year is unusually bright."

Milwaukee, Wis.—The first half of April has witnessed a very satisfactory continuation of the progress made in March by manufacturers of passenger cars and makers of automotive parts and equipment of all descriptions in this center. The same is true of plants at Racine, Kenosha, Hartford and other Wisconsin cities having industries of this class. During the past week the Mitchell at Racine has increased its daily production by 25 cars and the demand from distributors and dealers is broadening steadily. Its force of 650 is being increased to 800 or 900. The H. & M. Body Corp., also located in Racine and making open and closed bodies principally for Hupmobile and Mitchell, has orders on the books to keep up capacity operations for eight months ahead and is adding a night shift. It is gen-

erally admitted that the situation of the automotive industries in this section is on the best footing it has occupied in more than eighteen months, and there has been no development in the last six to eight weeks to interrupt progress, as was experienced frequently last summer and fall. That is to say, the course of the improvement is steady and even and it is this tenor which lends so much satisfaction and encouragement.

Columbus.—With the coming of pleasant weather and a noticeable improvement in industrial conditions, demand for motor vehicles, particularly passenger cars, has shown a good increase. Dealers and distributors in Columbus and Central Ohio are much more encouraged over the outlook. There is a much better feeling among the farmers with prospects for a good wheat crop.

Cleveland.—Reports of Cleveland automobile dealers that there has been an influx of factory workers into the market for new and used cars in recent weeks is borne out by the record of employment in local industries as made public by the Chamber of Commerce.

Employment increased in six out of ten industries surveyed during March by the labor solution committee of the chamber. The record on March 31 was 2.1 per cent in excess of the figures for Feb. 28.

The iron and steel industry with an increase of 5 per cent in the number of employees made the greatest gain, while the automobile and parts makers showed an increase of 1.5 per cent. Food, textiles, lumber and smaller miscellaneous industries showed losses, occasioned by strikes and local conditions.

Cleveland.—The peak of the spring buying of automobiles in Cleveland has not been reached, say representative retail automobile dealers.

General business conditions bear out what the automobile dealers say. Banks here report that the first half of April proved the most promising period since 1920 from many standpoints. While it is true that part of the improvement is seasonal and another part is due to certain industries that have had an extra run of patronage, yet reports show that the whole economic machine is moving forward and gaining momentum rapidly.

The City Employment Bureau states that there has been a substantial reduction in unemployment. There are many other evidences of improvement such as prices of staple raw materials are advancing; production of iron and steel is on the increase; prices of stocks and bonds are higher; interest rates are falling and building construction is increasing.

In the automobile industry the evidence unmistakably shows improvement. The National Acme Co.'s Coit road plant is running to capacity. The Murray Ohio Co., maker of fenders and other parts, reports it is working ten hours a day six days a week. In other lines like the Owen Shops Co., maker of upholstered furniture, trouble is experienced in obtaining a sufficient number of qualified artisans.

A canvass of automobile dealers here disclosed that the first half of April has been better than the fifteen days of the preceding month. In fact, April has been the best month of the present year.

Los Angeles.—Throughout the Middle West and

the West there is a marked improvement in business conditions, especially as affecting the automobile trade, declared Harry M. Jewett, president of the Paige-Detroit Motor Car Company, upon reaching Los Angeles.

"The farmers of the Middle West have considered themselves the hardest hit of any class in the so-called slump of last year," said Mr. Jewett. "They based their stand on the fact that they were not showing a profit on their investment, but the recent conference with Hoover at Washington sent them away with an entirely different understanding of their own situation. They had been figuring their percentages on wartime prices of land and products, and they had forgotten that the rest of us had been compelled to absorb millions in readjustment of inventory. Now they realize their mistake—and this, with the fact that snow and rains have assured them of bumper crops this season, has caused an opening up of the Middle West, such as has not been recorded since long before the war.

"The farmers really are in good shape financially and have the money to spend, but until recently they did not realize it. Now that they do, the Middle West is opening up—and the Middle West has been one of the most serious situations existent because of the widespread effect upon the rest of the country."

Reports from the South

Atlanta, Ga.—Automobile sales in the Atlanta territory have improved steadily for the past thirty or forty days, and while considerably better than during the same period one year ago, there is still plenty of room for improvement. The principal demand at this time is for the low and medium priced cars, though many more sales of higher priced makes are being reported than during the early spring of 1921. Most

of the dealers and distributors of Atlanta are looking forward to a fairly good business during the remainder of the spring and the coming summer.

One proof of improvement is noted in the records of the State automobile department, Secretary McLendon reporting that to date approximately 5000 more licenses have been issued than at this time in 1921. Up to April 1 of this year 94,000 passenger car licenses had been sold and 13,000 truck licenses or a total of 107,000. The 1921 total to April 1 was only 103,000.

As was the case last year most of the automotive sales are in the larger cities of the State, while business is still comparatively poor among the dealers in the smaller towns.

Truck sales are about on a par with those of a year ago and the outlook is not exceptionally bright, at least for the next few months.

Accessory and equipment sales are generally reported much better than the early part of 1921, with indications portending a fairly good volume for the next several months.

Tire sales also are much better than they have been in many months, and many of the dealers state they are experiencing almost normal business so far as tires are concerned.

Tractor and power farming equipment business continues at a low ebb, though somewhat better than it has been in the past several months. The outlook does not

INDICATIONS are that the first improvement in business conditions, in so far as orders received are concerned, is coming from the industrial centers and that the farmers as yet are responsible for only a small part of it. That the farmer will appear in force as a buyer later in the year depending in volume on the prices received for his produce, appears to be the general opinion.

Decrease in unemployment, improvement in banking conditions and a general increase in the volume of orders and business actually transacted, give a favorable outlook for the automotive industry for the year.

promise material improvement until the next crop has been gathered at least, due to the low financial condition of the farmers in the southeastern territory.

Detroit.—Sales throughout the Southern States are increasing rapidly, reported G. H. Peasley, sales manager of the Olds Motor Co., after returning from a trip covering Chicago, Oklahoma City, Dallas, San Antonio, Houston, New Orleans and Memphis.

Louisiana and southern Texas are showing the best business, he said. Business conditions in western Texas are being greatly helped by rains, but too much rain may damage rice and other crops in eastern Texas and Louisiana. Sport models are in special demand throughout the territory, some cities being sold ahead.

To meet the demand on sport models from all sections of the country the Oldsmobile factory reports advancing May quotas to meet April demands.

Pacific Coast

Portland.—Portlanders who feel that the automobile business has turned the corner on the way to better days had their judgment vindicated to a considerable extent by the record for March, which in many instances was characterized as very good, and in practically all instances, with standard dealers, was better than March of last year. Dealers and distributors handling the standard lines all reported a good business, somewhat uneven, but still aggregating an excellent total.

One rather unexpected feature has been the increase in demand for the higher priced cars. Cars in the price class of \$2,500 and above, which had not been moving to any extent, seemed to come to life again and, while figures are not available, it is estimated that this class of car was sold in better proportion in volume than for many months. One dealer in a popular make selling around \$3,500 here reported that March this year was one of the best years in his history.

Eighteen sales of a popular car in the \$1,000 class were reported one day this week. This is said to be the greatest number of cars of any one make aside from Ford ever reported sold here in one day.

New York State

Syracuse.—Increased activity in every branch of the automotive industry in this city is reported by fac-

tories and dealers. While few of the plants are on a normal basis, many of them have increased production within the last few weeks to such an extent that gear manufacturers and automobile makers and dealers are more optimistic than they have been in a year. The big gear plants are slowly getting back to normal, although it will be some months before all of them are on a full time basis.

Dealers report increased sales compared to the same time last year, and it is estimated that the number of automobiles in the county this year is at least 25 per cent greater than a year ago.

Franklin shipments for the week ending April 1 were greater than the entire month of February. The week was the largest of any in the last nine months.

Business in Canada

Toronto.—Automotive dealers in the province of Ontario report an excellent business which is steadily improving. March was the best month in the history of the Dominion Automobile Co., Ltd., distributor for the Essex and Hudson cars in Ontario. The same was true of the Toronto branch of the McLaughlin Motor Car Co.

The General Motors plants are working overtime with larger staffs than ever before. Ford is doing considerably better than last year and Studebaker has shown an increase every month this year, in spite of the fact that last year exceeded the peak production of 1920. The Durant jobs continue to receive much attention and patronage. Dodge Brothers is doing a very large business notwithstanding a flat refusal to accept trade-ins.

Montreal, Que.—Even the automobile dealers themselves are amazed at the big sales which they have been making in Montreal recently. Owing to the setback in general mercantile conditions, dealers were apprehensive regarding the sales they were going to be able to make this spring, and on this account made very limited reservations from factories. In face of this, one agency sold in the month of March alone fifty-eight new cars and twenty-nine used cars. In the case of the high priced models, sales for March are said to have run considerably ahead of the same month last year. If anything, however, it is stated that the French Canadian buyer is more largely represented this year than was the case a year ago.

Spanish Trans-Atlantic Air Service

A SPANISH-SOUTH AMERICAN airship service is being organized, according to the *London Times*. It is planned to have engineers trained in the works of the Zeppelin Company supervise the construction of the airships in Spain. In that country the whole of the building will be done, and the duralumin for the frameworks of the ships will be made there. Sites for aerodromes have already been taken over near Seville and Buenos Aires. Building will be begun next month.

Three revolving sheds will be put up at Seville, two large ones for the accommodation of three Zeppelin airships and a small shed to take a ship of less cubic capacity, which is to be flown to and from the Canary Islands for the instruction of Spanish airmen. The airships will be larger in volume than the R-38, and they will be driven by nine Maybach engines, each of 400 hp., four on either side of the envelope and one in the stern. The cabin will be placed forward. In it there will be quarters for the

pilot and his staff, a saloon, a kitchen, and a smoke room. Much space for baggage will be provided along the keel. Forty passengers will be catered for, but it is intended to give the bulk of the available carrying space to mails. A single journey a week will be made each way between Buenos Aires and Seville and the fare will be about £200. The letter fee will be about 18d.

It is hoped to begin regular flights in approximately two years' time.

A new type of mooring mast is to be used for the new service. The main principle in its design is that the mast is built into a deep socket in the ground, in which it is sunk when not in use. For the purposes of mooring, the line dropped from the airship is attached to the coupling gear on the mast before the latter is raised from the socket. When the airship is secured the mast is raised, and by means of a door in a turret in the top of it connection is made with the forward end of the airship cabin.

Exports of Passenger Cars, Trucks, Tires, Tractors,

COUNTRIES	GASOLINE PASSENGER CARS						GASOLINE TRUCKS						PARTS		ELECTRIC PASSENGER CARS AND TRUCKS	
	Up to \$800		\$800 to \$2000		\$2000 and over		Up to 1-ton incl.		Over 1 to 2½-ton		Over 2½ tons					
	No.	Value	No.	Value	No.	Value	No.	Value	No.	Value	No.	Value	Value	No.	Value	
Europe																
Austria.....													\$112			
Azores and Madeira Islands.....													827			
Belgium.....	357	\$121,177	6	\$5,518	1	\$2,275	120	\$34,114	1	\$1,257			7,303	1	\$900	
Bulgaria.....													435			
Czechoslovakia.....	1	435											91,427			
Denmark.....	10	7,240	5	4,074									583			
Finland.....													171,555			
France.....	10	4,661	1	2,000	1	3,270	2	748					2,000			
Germany.....	1	400	6	6,600					10	33,875						
Gibraltar.....													2,717			
Greece.....	9	3,817	1	1,605									167			
Hungary.....	2	936					1	389					2,372			
Italy.....													664			
Malta, Gozo, and Cyprus Islands.....	4	1,508											1,503			
Netherlands.....	55	37,778	6	6,374	4	19,000	24	9,294					5,523			
Norway.....			11	14,205									993			
Portugal.....													1,502			
Roumania.....																
Russia in Europe.....			1	1,500									27,075			
Spain.....	4	2,468	7	6,993									4,371	1	1,678	
Sweden.....	41	27,513	21	20,608									1,713			
Switzerland.....			3	6,000									2,872			
Turkey in Europe.....			1	2,000									394,295			
England.....	14	8,498	13	13,750	5	23,500			6	5,865			14			
Scotland.....													60			
Ireland.....													1,008			
Jugoslavia, Albania, etc.....			1	1,000												
North and South America																
Bermuda.....													236			
British Honduras.....													1,467,883			
Canada.....	236	144,367	249	290,591	51	156,726	3	3,478	53	61,029	5	\$9,638	76			
Costa Rica.....													3,015			
Guatemala.....													3,060			
Honduras.....	1	527											136			
Nicaragua.....							1	1,400					2,470			
Panama.....	2	1,200	2	2,718			4	1,698					35			
Salvador.....			2	2,839	1	3,000							56,615			
Mexico.....	345	141,143	132	158,564	7	25,689	59	23,510	23	27,622	6	12,293	2,359			
Newfoundland and Labrador.....			2	2,758									2,861			
Barbados.....	1	600	1	972					1	680			7,369			
Jamaica.....	19	10,333	10	10,657			4	1,698	2	5,300			3,029			
Trinidad and Tobago.....	4	2,721	1	850									1,627			
Other British West Indies.....	12	5,894	2	2,100			2	849			2	5,900	20,332			
Cuba.....	41	22,627	20	32,324	4	17,548			3	2,948			6,652			
Dominican Republic.....	4	1,741	1	1,600									719			
Dutch West Indies.....	6	2,526					1	424					904			
French West Indies.....	1	435											6,830			
Haiti.....	16	8,472					1	424					87			
Virgin Islands of U. S.....	2	815											247,494			
Argentina.....	13	8,826	66	68,391									127			
Bolivia.....													16,812			
Brazil.....	13	9,480	22	20,546	1	4,881							10,448			
Chile.....													9,132			
Colombia.....	5	2,009	2	2,831			3	1,274	1	934			1,500			
Ecuador.....													466			
British Guiana.....													980			
Dutch Guiana.....																
French Guiana.....	1	435											6,664			
Peru.....			2	1,912	1	3,000			1	1,211			8,704			
Uruguay.....	10	4,347	5	6,059									2,190			
Venezuela.....			1	1,125	3	10,500										
Asia																
Aden.....													81			
Ceylon.....	10	5,848	3	3,026							2	8,956	1,153			
China.....	19	14,187	10	9,340	2	4,920							5,623	5	2,675	
Chosen.....	1	500											547			
British India.....	20	14,546	68	70,248			2	2,052					24,183			
Straits Settlements.....	2	550											3,566			
Other British East Indies.....													35			
Other Dutch East Indies.....													497			
Java and Madura.....			60	51,402					1	3,925	1	3,220	14,902			
French Indo China.....													456			
Hejaz, Arabia, Mesopotamia.....													574			
Far Eastern Republic.....																
Hongkong.....					1	2,600							594			
Japan.....	104	41,455	15	20,798	1	5,300	50	25,980	9	22,379	1	5,000	30,432	3	8,589	
Palestine and Syria.....	42	18,720	13	12,501			2	1,000					2,767			
Persia.....													7,291			
Greece in Asia.....													97			
Siam.....													293			
Turkey in Asia.....																
Oceania																
Australia.....	311	192,353	164	175,815	20	80,000	7	8,855	17	25,450	6	10,240	51,886			
New Zealand.....	65	43,344	22	25,843	1	4,115			5	8,612			25,548			
Other British Oceania.....													432			
French Oceania.....													5			
Other Oceania.....													418			
Philippine Islands.....	25	12,504	21	18,841	3	6,889							5,772			
Africa																
Algeria and Tunis.....													5,711			
British West Africa.....	2	1,166							2	2,173			36,252			
British South Africa.....	20	13,199	113	115,190	3	6,950			6	6,944	4	8,100	4,341			
British East Africa.....	2	1,166											1,938			
Canary Islands.....	7	2,944	1	1,400									1,298			
French Africa.....	3	1,306											1,350			
Egypt.....	16	9,454	3	4,440									7			
Liberia.....																
Morocco.....																
Portuguese Africa.....	1	583											93			
Total.....	1,890	\$958,814	1,096	\$1,217,578	110	\$480,163	286	\$117,157	111	\$210,201	27	\$64,347	\$2,840,259	10	\$13,842	

Motorcycles and Aircraft for February, 1922.

TIRES						FARM TRACTORS		PARTS	MOTORCYCLES		AIRPLANES AND SEA-PLANES		PARTS	COUNTRIES
Casings		Inner		Solid		No.	Value	Value	No.	Value	No.	Value	Value	
No.	Value	No.	Value	No.	Value	No.	Value	Value	No.	Value	No.	Value	Value	
Europe														
904	\$17,368	637	\$1,405			16	\$7,698	\$200	77	\$21,349				Austria
16	164	16	39											Azores and Madeira Islands
1,014	15,348	276	606	78	\$3,553			87	2	375				Belgium
2,565	27,968	180	301			50	19,354	1,814	32	5,227				Bulgaria
164	2,615	71	277	2	113				1	350				Czechoslovakia
1,803	34,913	1,540	3,053	15	522	1	421							Denmark
568	7,875	472	891			6	2,371	520	87	23,010				Finland
44	591	8	31			1	423	425						France
494	7,554	245	469	3	215			80	287	78,929				Germany
1,756	35,559	1,346	3,219					425	109	28,661				Gibraltar
529	8,688	456	1,105											Greece
240	5,999	50	195					41						Hungary
929	13,065	231	635	8	697	1	375	31	59	16,473				Italy
1,285	21,179	891	800			1	400							Malta, Gozo, and Cyprus Islands
17,951	220,820	6,509	9,834	178	5,424	5	2,299		20	6,555				Netherlands
						1	676	3,258	25	6,383				Norway
														Portugal
														Roumania
														Russia in Europe
														Spain
														Sweden
														Switzerland
														Turkey in Europe
														England
														Scotland
														Ireland
														Yugoslavia, Albania, etc.
North and South America														
6	90		15					19						Bermuda
4,730	63,703	5,988	18,228	176	6,294	73	51,418	18,810	35	8,888				British Honduras
63	1,355	37	74											Canada
108	2,584	104	282	2	70				1	148				Costa Rica
26	720	22	67											Guatemala
4	114													Honduras
652	8,915	881	1,525	20	667			629						Nicaragua
47	1,006	14	69					125	1	100				Panama
4,397	71,769	5,814	14,554	261	9,972	19	16,395	37,189	9	1,726				Salvador
4	59							91						Mexico
120	1,594	61	177											Newfoundland and Labrador
942	13,008	869	1,440	137	3,326			47						Barbados
211	2,847	127	321											Jamaica
50	523	47	127											Trinidad and Tobago
7,730	91,899	4,440	8,364	345	7,930	1	2,000	2,122	1	125				Other British West Indies
196	3,681	234	424					200						Cuba
67	922	66	101											Dominican Republic
202	2,672	30	60	4	82			26						Dutch West Indies
79	1,674	40	111											French West Indies
91	1,352	90	140					384						Haiti
3,930	65,381	3,857	7,796	4	215			5,193	10	2,860				Virgin Islands of U. S.
41	1,547	83	249											Argentina
817	11,398	450	797	10	143	1	671	781						Bolivia
763	12,141	592	1,615	10	159			2,898						Brazil
275	6,475	231	574	38	1,197	1	935	1,145	1	306				Chile
304	3,719	153	295											Colombia
84	916	185	293											Ecuador
420	7,610	497	970	24	1,074			354						British Guiana
1,028	15,503	126	195	10	180	20	7,292							Dutch Guiana
1,190	19,218	900	2,022	34	224			198						French Guiana
														Peru
														Uruguay
														Venezuela
Asia														
12	249													Aden
78	1,884	51	138			2	300		1	400				Ceylon
														China
329	3,738	180	308	45	1,488	1	5,243	57	21	5,795				Chosen
1,190	15,584	1,121	1,892	309	6,300			9						British India
														Straits Settlements
														Other British East Indies
969	12,090			24	969			259						Other Dutch East Indies
								38	32	8,135				Java and Madura
208	5,852	82	209											French Indo China
58	1,531	58	169											Hejaz, Arabia, Mesopotamia
														Far Eastern Republic
267	4,863	75	200	176	3,172	1	1,975	688	18	4,400				Hongkong
314	3,115	208	506					103						Japan
														Palestine and Syria
														Persia
														Greece in Asia
20	354													Siam
1,065	14,481	875	1,782	220	7,139			188	120	33,316				Turkey in Asia
1,111	21,591	496	1,669	70	2,407	15	8,713	1,023	11	3,140				Oceania
8	115			2	77									Australia
13	175	2	4	3	109									New Zealand
1,740	24,245	2,177	4,569	160	4,075			1,269						Other British Oceania
						2	774	522	1	390				French Oceania
401	10,828	814	2,617											Other Oceania
4,309	62,258	426	1,296					250	4	1,115				Philippine Islands
417	6,389	91	250											Algeria and Tunis
83	1,347													British West Africa
														British South Africa
146	1,676							608	4	1,271				British East Africa
														Canary Islands
240	1,971	105	188											French Africa
														Egypt
														Liberia
														Morocco
														Portuguese Africa
\$73,787	\$1,028,467	46,941	\$101,301	2,388	\$68,233	218	\$129,733	\$82,415	960	\$259,347			\$10,146	Total

Fundamentals of Labor Question Ignored

Efforts toward improving industrial relations largely abandoned. Control of labor through economic conditions only postpones the final settlement. Labor study tends to find an immediate solution to a specific problem rather than to understand fundamentals to achieve a permanent solution.

By Harry Tipper

A SURVEY of the country in the automotive field indicates very thoroughly the extent to which industrial relations efforts have been abandoned. Employment managers remain and in many instances these employment managers are attempting to improve the morale, conscientiously endeavoring to provide a better spirit among workers. They are hampered by the circumstances. In the fluctuating employment little can be done to improve the situation between the workers and their supervisors while, under the prevailing impression that labor is beaten, the desire for better relations and better understanding seems to have gone into the discard almost entirely. There is a widespread belief in manufacturing circles that labor is definitely beaten for a considerable time and that it is possible for the manufacturer to place himself in a position of virtual control again. This is the idea behind the refusal of the coal operators to confer with the miners in accordance with the terms of their agreement. It is also the reason for the general abandonment of work in industrial relations within the plant, the advocacy of the open shop, and the bitterness expressed in many quarters towards the unions. This attitude is all the more interesting in view of the past history since the industrial system began. Strikes have been defeated, unemployment has occurred and labor has been beaten many times during that history only to organize more carefully a little later on.

It is true, there is no actual necessity for placating the worker at this time. There is little necessity for worrying about the price to be paid, but that is not the point. As things are going to-day, the next era of more or less full employment will find the manufacturer as badly off as he was in 1920. He will learn practically nothing by his previous experience, and the general situation will not be improved in any large measure. When labor is scarce and wages high, the efforts of the manufacturer to establish decent industrial relations are viewed with suspicion. They are figured as part of the scheme to keep wages down. In other years they were suspected as

a part of the deep policy of the manufacturer to undermine the labor organization. No such suspicion can attach to efforts that are made during a time like the present. There can be no element of self-defense in the study of the problem by the manufacturer, and such study is not likely to weaken the actual antagonism of the labor union as it would have done in 1920. The labor problem is not a temporary one. It is not concerned with the growth of this or that union or the payment of this or that wage scale. It is a perennial problem which has

grown more acute as the industrial system has grown more complicated. It is not settled because a few strikes are beaten or because a few organizations are temporarily weakened. It can only be settled within the plant, and the operations of the plant management in this direction are still the most important operations for increased efficiency that can be made.

The factory labor on an automobile varies from 15 to over 20 per cent in the examples which we have been able to secure. A reduction in the wage rate such as has taken place between 1920 and 1922 in the skilled trades will make some difference in costs, but it will not bring the economies required by the great

reduction in prices. Prices are being made all along the line without any particular record for cost at the present moment. The raw material man, the man who is selling supplies and parts, all along to the man who is selling complete cars, have been cutting prices to meet the market and the adjusting costs as best they can. It is still possible to secure more reduction of labor cost per unit of production by the proper management of industrial relations than by a reduction of the wage rate, and, in the plants where the industrial relations have been amicable and carefully considered and there is a unity in the organization, reductions have been accepted or suggested by the workers without difficulty and the efficiency has been maintained or increased. The manufacturer can get by for the present moment of depression with his problems based upon supply and demand and control all the working conditions. Getting by will not

THE greatest waste of industry to-day is human waste and the great advance in efficiency will be made by an advance in orderliness and the lack of interruption and increase in working capacity of the individual. It is disturbing to find the manufacturers giving up all study of this kind so readily and lacking an apparent appreciation of its importance from a business standpoint. Reports from various parts of the country indicate that employment managers and general executives interested in the wage and labor situation believe that this is a matter of supply and demand and apparently believe that the alternate prosperity and depression will answer all the requirements in the relation between the management of a company and the workers.

solve his problem, neither his cost problem nor his problem of a sufficient supply of skilled labor at all times on a reasonable basis, a lessened "turnover" and a greater efficiency.

It is evident that the apparent study given to the labor question in 1919 and 1920 was very largely due to the immediate question of looking for some special way of meeting the problem and not a desire to understand the question fundamentally so that it could be met, not for a year, but for any part of the life of the business. Skilled labor has not been reduced to the same extent as the unskilled labor in many lines and the reductions have been more uneven. The highly organized trades are resisting the reductions more successfully, and there is a great activity in workers' organizations not for immediate purposes but to secure an increased strength when the present acute problem has passed mostly away.

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in the wage and labor situation believe that this is a matter of supply and demand and apparently believe that the alternate prosperity and depression will answer all the requirements in the relation between the management of a company and the workers.

This is not the case in Europe, where the desires and aspirations of the workers have proved to be of sufficient importance to demand attention before the industrial machinery can be set to work properly and kept in proper motion. The working of this law of supply and demand for 400 years in the industrial system has increased the number of adherents to workers' organizations from a few hundred to some thirty million in the various countries, so that it is not likely that the workings of this law will reduce either the number or the strength of such organizations. Moreover, industry is not concerned with ruling the worker. Industry is concerned entirely with securing the largest amount of work for the least possible amount of money per individual piece. It still remains that a company of men working in harmony with a community of purpose and ideas and some sound trust in each other can accomplish more at less cost than men who are working because it is necessary. This is the meat of the matter and it is only in this way that the full benefits can be secured by modern industry in the handling of its labor to economic advantage.

Headlight Tests and Regulations

A GREAT deal of interest is now being shown in regulations governing the headlights used by motor vehicles. The Bureau of Standards has assisted local authorities and the manufacturers through tests of these devices, and already quite a number of the states have framed laws to govern the use of lights on automobiles. The matter is one which should receive uniform treatment, and this has been recognized by nearly all those concerned in the subject.

In order to secure a satisfactory degree of uniformity in all parts of the country it will be necessary to have (1) uniform laws, (2) uniform procedure in the enforcement of the laws, and (3) an extensive campaign of education for enforcement officers, garage men and drivers of automobiles.

The establishment of headlight adjusting stations in garages has been found to be a very desirable step, and they have already been used in a number of states and cities under more or less definite official regulation. So far uniformity of legislation has been based upon the specifications formulated by the Committee on Motor Vehicle Lighting of the American Illuminating Engineering Society. These specifications have been adopted in practically the same form by nearly a dozen states. At the time they were formulated it was believed that the specifications were as rigid as could be enforced, but recently even more rigid regulations have been adopted in some sections.

In view of this situation, the above-mentioned committee decided that a revision of its specifications should be made. In accordance with this decision, the values specified for light on the road were considerably increased, while the limiting values, which are intended to control glaring light, were left unchanged. Other changes were also made.

With the idea of securing uniformity in the adoption of regulations, an informal organization of State authorities representing the whole of New England, New York, New Jersey, Pennsylvania and Maryland has been

formed. Another meeting of this organization will be held at Harrisburg in April, and it is understood that an attempt will be made to establish a board of officers which will be charged with the approval of devices in all the states represented.

A RECENT letter from a resident of Brisbane, Queensland, Australia, which was published in the British paper *Motor*, tells some facts regarding the local automobile market which should be of interest to the American manufacturer. He admits that the State is almost entirely held by the "Yankee" product, but hopes that the English manufacturer will go after the market.

The fact that the American cars are almost entirely from the low-priced, light-car group gives an idea as to the type of car best fitted for that country.

He asks two leading questions:

1. Is the British manufacturer going to maintain his enthusiasm for the small car?

2. If he exports, will he take any interest in the product after it leaves his hands?

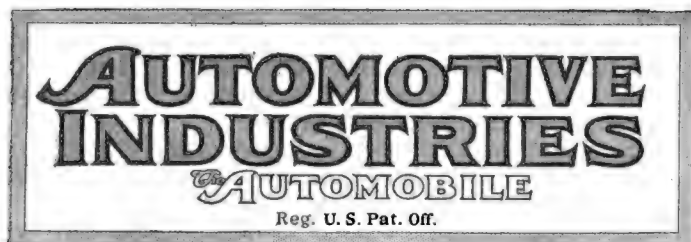
At present Queensland has suffered financially with the rest of the world, but the writer believes that the British light car would have a chance if pushed hard. He maintains that the following things must be done to insure any measure of success:

1. A reduction in price to make real competition with the American medium-power car.

2. Actual samples on the spot, vigorous advertisement via the press, active entry for all A. C. Q. events, such as hill-climbs, reliability tests, fuel consumption, and so on.

3. Genuine spare parts, standardization and, say, a six months' guarantee.

Each American manufacturer represented in Queensland should be able to tell in a measure what he has done and what he has left undone to win and maintain the market according to the writer's idea of what actions are necessary for the British manufacturer to succeed.



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A Forward Step

A PRODUCT is manufactured at the lowest possible unit cost when the fullest powers of the various workmen as well as of the various machines are called into play. As the individual is made capable of assuming increased responsibility, the necessity for supervision and administrative expense decreases. While there has been a general tendency to disregard the production importance of these fundamentals during recent months, there are striking exceptions here and there throughout the industry.

The Oakland factory, for example, has in operation a plan which tends toward the better development of the capacity of individual workers and which operates to procure both better quality and cheaper production. The plan is explained in a bulletin issued by the company as follows:

"Every new employee is thoroughly taught the particular operation he is called upon to supervise. In addition he is taught the principles of the operation of the employee preceding him and also of the employee who performs the next operation after him.

For every employee inspects the operation of the man preceding him before doing additional work and inspects his own work before sending it on to the next man. These inspections are made beside many inspections of the regular inspecting force. The thought underlying this system is not to have one employee discriminate against another, but to see that there is no let-down in quality of work done.

"The secondary result of this system is to keep on hand at all times a body of skilled mechanics. There are no green hands called upon to fill any position. All the men required for the most difficult positions are recruited from within the Oakland factories. There is ever a promotion of the older, more skilled employees to the higher positions. In like manner all the inspectors at the factories are chosen from among the men who have held several positions and who know from actual experience the kind of perfect workmanship that is required."

This is an excellent practical example of how the idea of developing the individual worker may be worked out. Such a plan does not solve the labor problem, nor was it installed for any such purpose. It does constitute a step in the direction of constructive progress. The idea behind the plan is based upon production practice and human psychology that is fundamentally sound.

Alcohol Fuel in Exported Vehicles

MANY automotive manufacturers are looking more and more to foreign markets to absorb a portion of their products and they are consequently interested in the conditions which must be met to satisfy customers in these markets. In all or nearly all countries outside the United States and Canada the cost of gasoline is so much greater than it is in this country that substitutes are frequently used and there is more incentive to consider the matter of fuel economy.

In Brazil and in the Spanish speaking countries of South and Central America, the West Indies and even in Hawaii and the Philippines alcohol is either being used or discussed as a possible future motor fuel. As might be expected, this fuel does not give entire satisfaction in vehicles designed to run on gasoline, even though it is, in some respects, a better fuel. Some of the reasons for this were set forth in an article entitled "The Use of Alcohol in Exported Vehicles," which appeared in AUTOMOTIVE INDUSTRIES for April 6. This article also gave figures showing how extensively fuel alcohol is already used.

Those who have made a study of the export market believe that cars, trucks and tractors especially fitted up to burn alcohol will find a ready sale. The changes needed in standard gasoline vehicles are not of a radical nature, but exact information as to the most economical compression ratio, the quantity of heat required for satisfactory vaporization, the most economical mixture ratio, and the best metals to resist corrosion is lacking, although some data on these points are available.

In short, the subject is in need of further study, and considerable research work is required before the best results are obtained. But the subject is not simply academic. It is of immediate practical interest and should be seriously considered by manufacturers who might well see that Congress appropriates funds to carry out research work on this and related subjects at the Bureau of Standards and in such other Government laboratories as are equipped for the work.

We shall welcome discussion of the subject in the Forum and be pleased to receive any authoritative data regarding the performance of automotive equipment using alcohol fuel. Interchange of information along this line will certainly benefit all concerned.

Will Distributor Study Markets?

MANUFACTURERS seem to be agreed that the distributor cannot be depended upon to secure comprehensive or accurate market analysis data. Consequently such essential work is being undertaken by the factories. This is necessary in view of the facts which must be faced.

Nevertheless, the factory will reduce the cost of its analysis work if efforts are continuously made to explain to the various distributors what it is all about, the practical value it has for them, and how they can use the results of such analyses in their selling effort. To do this will be extremely difficult in some cases and nearly impossible in others. It should be recognized, however, that in proportion as the distributor becomes interested and active in this work, the relative cost of carrying it on decreases from the factory standpoint. Moreover, the distributor is better able to carry on his work, sells more cars, and makes more money.

Distributors sometimes think that factory market analysis work is against them rather than with them. They have a suspicion that the factory is merely going through a lot of statistical gymnastics, purposely devised so that the distributor cannot understand them, with the idea of forcing him to take more cars than he wants—or in good times of keeping from him some cars that he does want.

From every standpoint it is worth while to continue the effort to sell the distributor on the idea of market analysis and market studies.

Two-Stroke Engines in Europe

RECENTLY there has been a notable increase of interest in two-stroke engines among European designers of passenger cars. In the British motorcycle field the two-stroke engine has always occupied a position of considerable importance, and from this field it is now forging its way into the cyclecar and light car fields.

Having had an extensive try-out in the United States and been discarded as a car engine, it is rather surprising to see the two-stroke turn up in Europe again, but if the situation is carefully analyzed the present European interest in the engine does not seem so illogical.

The two-stroke engine, in its simpler forms at least, has two shortcomings which led to its abandonment in this country. One is that it is less economical of fuel than the four-stroke engine, especially if it is designed for operation at high speed and to this end provided with ports of considerable depth. The second is that it cannot be throttled as well as the four-stroke engine. Perhaps this latter disability should have been placed first, as it was undoubtedly the chief cause for its failure to satisfy car owners here. The cost of fuel was not as yet considered very seriously at the time of the two-stroke's decline as a car engine in this country.

The great advantage of the ordinary two-stroke engine is its simplicity, as a result of which it is cheap to manufacture and easy to maintain. Its inherent weaknesses, of course, are also closely bound up with this simplicity, and all attempts to overcome these weaknesses have resulted in complication, and thus at least partially eliminated the advantages over the four-stroke engine.

It is to be noted that the class of car for which European engineers are now selecting the two-stroke engine is the lightest and cheapest class which has to be built "to meet a price." The purchasers of these cars are not particularly exacting in respect to flexibility of the engine, and the simplicity of the design, with its entire absence of any valve gear, appeals to them. The lack of economy might be expected to be the greatest handicap of the engine, but the designers have concentrated their efforts on the elimination of this weakness and no doubt have succeeded to an extent. Quite a number of the engines are air-cooled, and air-cooling, in the estimation of many engineers, tends to greater fuel efficiency. All of the engines are small and therefore not great fuel consumers, and the advantages of low price and simplicity probably make a stronger appeal to the customer than a slight superiority in fuel economy would.

The Tractor Market

THERE are indications that the tractor business is picking up. Reports show a very healthy demand and a much greater interest in the possible purchase of them.

One dealer sent out a given number of letters to farmers, asking whether they were interested in the purchase of a tractor. This letter was sent out for three successive years and the replies tabulated. The results were as follows: Taking the year 1920 as a basis, in 1921 the number interested decreased 44 per cent, while in 1922 the number increased 329 per cent. This may be taken as a very good omen.

"There is many a slip 'twixt the cup and the lip" may be said in this case to mean, "There's many a slip b'twixt the interest and the sale," but if we know that the market is there and that the farmer's interest is backed up by an improved financial status then it is up to the tractor manufacturer to perfect his sales organization so that there may be as few slips as possible between the genuine interest and the bona fide sale.

Sales Keep Abreast of Factory Output

**Production Still Speeding Up—
No Large Surplus of Finished
Vehicles Carried**

By James Dalton

NEW YORK, April 18—With April more than half gone, manufacturers of motor vehicles still are speeding up production. There is every reason to believe the month will show a gain over March as was recorded by March over February. That was approximately 32 per cent and it was 65 per cent in excess of the preceding March.

Sales at retail, so far as can be determined, are keeping practically abreast of production. It is certain, at any rate, that no large surplus of finished products is being built up.

Up to this time the industry has been rather hesitant about accepting the theory that the country actually has begun the long swing back from depression and even now there is no disposition to abandon caution in commitments, but it is generally believed that any decline in sales this year will be merely seasonal.

Company after company is coming through with reports of greatly increased output for April. This applies to truck manufacturers as well as to those in the passenger car field. The largest producers of heavy duty vehicles assert that April orders will exceed any month since May, 1920. Makers of light trucks agree that business is excellent. Ford production is approaching capacity but the proportion of trucks turned out is much larger than it has been in many months.

Dealers Optimistic

Dealers everywhere are as optimistic as builders. Factory enthusiasm, in fact, is based solely on sales. Not only is there a strong demand for new vehicles, but the market for used cars is so strong that in most places they have ceased to be a sales deterrent.

Demand for motor vehicles is not peculiar to a few sections of the country but is practically universal. Even the South and the grain growing sections of the Middle West are buying in considerable volume. The farm market generally is steadily expanding, especially for commercial vehicles. The same is true of the industrial centers. Business in Canada is keeping abreast of the United States.

It is reported in a few of the larger cities that factory workers are begin-

Business in Brief

NEW YORK, April 18—Trade and industry generally continue their upward trend in spite of rains, bad country roads and strikes. The strike situation is no less serious and there are no indications that the mine walkout is any nearer an end than the day it was called. It has not yet affected industry, except iron and steel to a small degree.

The winter wheat crop has made a further gain notwithstanding an excess of rain. Spring seeding has been somewhat delayed by bad weather in some sections.

Export trade apparently has turned the corner. March recorded really definite gains.

Financial developments are practically all favorable. They include immense sales of bonds at steadily rising prices, sustained strength in the stock markets, more pronounced ease in money markets at home and abroad and continued strength in exchange rates.

Great improvement in buying of lumber, builders' hardware, cement, paints and other materials by the forward surge in construction activities is releasing huge sums of money and taking up the slack of unemployment.

Cotton consumption and exports are increasing in the face of the New England strike.

There is heavier buying of hides and leather.

The iron and steel industry has witnessed another buying spurt with advances in prices of many grades. Mills in the Chicago district are operating at 80 per cent of capacity.

There has been a very definite improvement in sales and credit conditions in the South.

Willys Is Optimistic on Return from Tour

**Deliveries for Second Quarter
Will Be Limited Only by
Production Capacity**

NEW YORK, April 17—The second quarter of 1922 would be the largest in the history of the Willys-Overland Co. if it could deliver all the cars for which it could get orders. It is estimated that sales of Overlands and Willys-Knights for the quarter will aggregate 37,000, but it would be possible to raise this number to 50,000 if that many cars could be turned out. This was a message brought to New York this week by John N. Willys after a seven weeks' trip in which he covered 18,000 miles, talked to 2500 dealers and all the distributors in the western territory.

While the company is in the unhappy position of not being able to take care of all the business it can get, there is no intention of departing from the conservative policy which has been in force at the Willys-Overland plant since the company began to recover from the depression. Willys would prefer a surplus of orders rather than a surplus of finished cars for which there is no market.

After his trip to the Coast by way of the northern route, then down through all the coast states and back to Toledo by the southern route, Willys was optimistic over the business outlook. In every section he visited he found a material improvement in general business conditions, resulting largely from increased prices for lumber, wool, livestock and agricultural products. The rapid return of confidence is, to him, the most encouraging feature of the situation. He believes that the relative prosperity which now is being experienced generally will continue, although he does not expect a boom.

Company's Affairs Improve

So far as Willys-Overland is concerned Willys is entirely confident. There still are a few difficulties to be ironed out, but the affairs of the company have shown an extraordinary improvement in the last few months. All possible losses have been taken, and operations are on a substantial basis, which undoubtedly will show a profit for the year.

After spending the week-end with his family here, Willys returned early in the week to Toledo, where he will spend most of his time in future. Although he has been on the road almost continuously for many weeks, conferring with distributors and dealers, this work will be continued for the next two months. The enthusiasm with which he has imbued the company's distributing organization has been reflected in the phenomenal business for the past five or six weeks. There is a strong demand for both Overland and Willys-Knight cars in all sections and Willys says they are giving entire satisfaction to purchasers.

ning to buy used cars and inexpensive new cars. It is significant that the bulk of the passenger car buying is in the low and middle price classes. The percentage of increase in these fields is much greater than in the high price class although a few companies turning out comparatively expensive products are having the best business in their history.

Production in parts plants continues to gain rapidly and many of them are having the largest business in nearly two years. Several expect April to be the best month in their history.

POLAND FORBIDS CAR IMPORTS

NEW YORK, April 18—The importation of passenger cars and bodies now is forbidden in Poland.

Nash Will Direct Pierce-Lafayette

To Formulate Selling and Manufacturing Operations After Consolidation

NEW YORK, April 18—Detailed plans for the consolidation of the Pierce-Arrow Motor Car Co. and the Lafayette Motors Co. are being worked out following a conference of bankers and officers at which the plan was agreed upon in principle. C. W. Nash, president of Lafayette and of the Nash Motors Co., will become chairman of the board of the consolidated companies, while Colonel Charles Clifton, chairman of the board of Pierce-Arrow, will serve as president. Nash will have charge of all operations. He will shape the selling and manufacturing policies.

It is understood there will be no new financing in connection with the consolidation, as stockholders of both companies will exchange their stock for securities of a new company which is to be organized. No title has been selected for the new company, but it is intimated that the name of Pierce-Arrow will be retained. The banking house of J. & W. Seligman & Co. has been interested in the affairs of both Pierce-Arrow and Lafayette for some time, while Lee, Higginson & Co. have been interested in Lafayette. Both houses will be represented on the board of directors of the new company.

Better Production Facilities

It is understood one of the factors which led to the proposal to consolidate is to be found in the fact that the excessive manufacturing space of Pierce-Arrow can be utilized to turn out bodies for both Lafayette and Pierce-Arrow cars. Lafayette has been experiencing difficulty in obtaining satisfactory bodies for its chassis. Nash is quoted as having said that the Pierce-Arrow plant turns out the best passenger car bodies available.

The plans do not contemplate any immediate change either in the Pierce-Arrow or Lafayette lines. Both are in the higher class field. The Pierce-Arrow is powered with a six-cylinder engine and Lafayette with an eight cylinder. The Lafayette phaeton sells for \$4,090 and the Pierce-Arrow for \$6,500.

Pierce-Arrow has taken heavy losses in the last two years, but there has been a very sharp upward turn in its sales, both of passenger cars and trucks, in the past few months, and it is expected to show an operating profit this year. Lafayette also has been experiencing financial difficulties in the past few months, and some time ago asked for the cancellation of its commitments for materials. It was understood this step was taken at the demand of bankers.

Nash Motors will not be involved in the consolidation any more than it has been with the Lafayette company. Both are

Amount of Truck Business Is Large Now and Capacity Volume Is Promised

By Martin L. Pulcher

Vice-President and General Manager of the Federal Motor Truck Co., and President of the National Association of Motor Truck Industries

Detroit, April 17.

IN this day of returning business in the motor truck industry it is of the utmost importance that the manufacturer take a long look into the future and make his plans accordingly.

The motor truck business is going to continue long after the day of many of the companies now in it. How long many of the present companies are to continue is largely a matter of their ability to analyze the fundamental requirements of the business and their capacity to meet them.

Most important of all considerations is the merchandising policy. Manufacturers without a strong selling organization or the ability to develop one might as well get out of business now and as quietly as possible. The best trucks in the world stored in the rear of any factory will never produce a cent of profit.

Trucks should be fathered almost in the sense that a child is and this fathering carried through until the truck has completed its mission as a business adjunct. It is not enough for the manufacturer to sell the truck to a distributor or the distributor to a user. Both manufacturer and dealer must be in position to help the owner keep it operating. Manufacturers unable to do this or manufacturers with dealers unable to do this are not operating on a basis sound in its possibilities for the future.

There is a large amount of truck business now and promise of capacity business soon. For the present, manufacturers are content to trail with this business rather than seek to control it. For this reason demand is running in excess of supply. As the trend of business becomes more definitely established the truck makers will meet the demand with spot deliveries. It is unwise to take chances on creating a surplus.

Factors making for truck business now are the rapid growth in building operations and the opening of extensive road building operations. Material prices in these fields are low. The number of idle freight cars is decreasing and some roads are placing orders for new cars. This means motor truck operations on both ends.

Practically all of the surplus war trucks have now been distributed, removing a serious sales resistance factor for the truck manufacturer. Used trucks do not exist in any quantity. War trucks shipped back from abroad in good condition have, for the most part, been sold. There is no market for the others. Steps have been taken to prevent any more coming back.

Taking all these factors into consideration, there remains only the question of continued restoration of general business. Indications are that it will continue its strides. Later on this year, with fair prices for farm produce, there will be large developments in this field.

With all these harbingers of business there should be no pessimism for motor truck manufacturers who are solidly established. Good trucks, sold right and properly maintained, will command the market.

controlled by Nash. Until the merger is completed, Colonel Clifton will serve as chairman of the board and president of Pierce-Arrow.

Stockholders' Meeting Postponed

BUFFALO, April 19—The meeting of stockholders of the Pierce-Arrow Motor Car Co., which was to have been held at the plant yesterday afternoon, was indefinitely postponed because a majority of the stock was not represented. Nothing of a definite nature was announced regarding the merger of the company with the Lafayette Motors Co.

Myron T. Forbes, vice-president and general manager, issued a statement in which he said there was no announcement to be made at the present time concerning the merger and the plans for the future would not be discussed. He had just returned from a visit to the Lafayette plant at Indianapolis.

Peerless March Business Approach High Record

CLEVELAND, April 18—Peerless Motor Car Co. shipments during the second week in March, including two entire trainloads, were exceeded only twice in the history of the company and then only by margins of eight and seventeen automobiles respectively. The total March business has been exceeded in only one previous March in the history of the company.

Monthly manufacturing schedules have been increased to keep up with the orders, and overtime is common at the factory.

When R. H. Collins came here as president and general manager of the Peerless company he set before his organization the task of producing and selling during the first six months of 1922 more than the entire total of Peerless production and sales during 1921.

\$9,188,561 Is Sought from Lincoln Motors

Government Files Suit in Detroit Against Old Company on War Contracts

DETROIT, April 18—The United States government has filed suit for \$9,188,561 in Federal court here against the bankrupt Lincoln Motors Co., which brought \$8,000,000 when it was sold recently by the receiver to Henry Ford.

The suit was filed by Earl J. Davis, United States District Attorney, who received the papers from Washington. The government claims the amount asked in the suit was the sum which the Lincoln company was overpaid on war contracts for Liberty motors.

When the property was purchased by Henry Ford on Feb. 4, the debts of the company were estimated at \$11,170,000, including a contingent liability of \$1,500,000. The unsecured claims amount to \$8,670,000.

Assets were carried on the books amounting to \$15,061,492, but appraisal by the Detroit Trust Co. as receiver fixed them at \$9,073,105 and the liabilities at \$9,490,811.

The new Lincoln Motor Car Co. will not be affected in any way by the suit.

Will Press Suit

WASHINGTON, April 15—The government's claim against the old Lincoln Motor Co. will be pressed, it is asserted by Attorney General Daugherty after a conference with counsel representing creditors of the defunct company whose claims amount to approximately \$9,000,000.

The creditors were represented at the hearing, over which Daugherty personally presided, by Harold H. Emmons of Detroit, acting for the Detroit Trust Co., receiver. There are approximately 900 creditors, Emmons said after the meeting, and to pay their claims there is available \$5,000,000 out of the \$8,000,000 paid by Henry Ford for the property. The other \$3,000,000, he added, represented preferred claims, including labor, mortgages and city, state and county taxes.

The following statement was issued by Daugherty at the close of the hearing:

As was planned, a final hearing of the controversy involving the Lincoln Motors Co. has been held. It was participated in by a greater number of officials of the Department of Justice than generally participate in hearings of this character. It is customary upon request for the department to hear those against whom the government is pressing a claim as a matter of courtesy. This hearing was insisted upon by the receiver of the Lincoln Motors Co., an officer of the United States Court who represented more than 900 creditors.

The department thought it fair to grant this hearing under the special circumstances of the case. No time has been lost and no money has been lost to the government in affording an opportunity for this hearing. The hearing was concluded after a two hours'

session and a decision was promptly reached that the government proceed in an orderly way to file and press the payment of this claim. It will no doubt promptly reach the Federal Court, where the whole matter of the liability of the parties will be determined.

Representatives of the War Department, the Department of Justice, the judge advocate's office, with legal and accounting counsel, participated in the hearing.

In a statement issued earlier in the week Daugherty declared that the case of the Lincoln Motors was brought out into the light through the desire of a former solicitor of the department to make trouble. The former employee referred to was H. L. Scaife, former solicitor and investigator, who had resigned because, he alleged, the government was not taking proper action to follow up evidence uncovered against the Lincoln and other concerns having contracts with the government.

(Continued on page 893)

Kelly Tire Eliminating All Its Own Salesrooms

NEW YORK, April 14—Consolidation of the general offices of the Kelly-Springfield Tire Co. at 250 West 57th Street, this city, was designed to organize more efficiently the executive branch of its business. A significant feature of the reorganization is that the New York branch has been moved to the company's warehouse at 553 West 57th Street, a step which is really equivalent to giving up the branch altogether since it now has no display rooms or sales counters.

The company explains its action on the ground that with the stabilization of the industry there is no need for the maintenance of these expensive establishments. With the discontinuance of all retail sales by the company, the factory branch was deemed a needless expense. This overhead burden will be eliminated in all cities as soon as practicable, and warehouses will be established in various centers of distribution where railroad facilities are best suited to give prompt service to dealers. In all these cities the branches will be supplanted by offices.

Reorganized American Bearings Buys Plant

INDIANAPOLIS, April 18—The American Bearings Corp. has bought a factory building here from T. B. Laycock, Son & Co., manufacturer of juvenile bicycles. The negotiations are said to have been pending for some time. The bearings company has been installing machinery in the plant for two weeks.

The bearings company is a reorganization of the American Bearings & Die Casting Corp., which went into the hands of a receiver last July. Since the reorganization, it has been operating on another site in this city. The officers are Arthur Dixon, president; William Fletcher, vice-president, and Paul J. Moore, secretary and treasurer.

Frontenac Acquires Indianapolis Plant

Expects to Be Operating It Within 30 Days—To Make All Units There

INDIANAPOLIS, April 15—The Frontenac Motor Co. of America, which is to manufacture the new four cylinder motor car designed by Louis Chevrolet, has purchased the plant formerly operated by the Empire Motor Car Co. of this city. The plant was built originally and operated by the Federal Motor Co., and the purchase was made from that company.

Situated at Fifteenth Street and the Big Four tracks (Indianapolis), the plant affords more than 100,000 sq. ft. of space. The main structure is a one-story building of saw tooth construction, which will be used for machine shops and assembly. A three-story structure nearby will take care of the balance of the manufacturing plant. In addition there is a two-story office building which will house the executive staff.

Directors of the company state that work will begin at once to put the buildings in shape for production and that all necessary equipment and machinery has already been bought. Officials say they expect the plant to be in operation within thirty days. The first sample cars are expected to be ready by the latter part of May, and production in a limited way will be in process by the latter part of June.

William N. Thompson, president of the Stutz Motor Car Co., who has been prominently identified with the Frontenac company of which he is a director, says that when the Frontenac reaches full production more than 1500 men will be employed. He also says that all the units will be built in the newly acquired plant.

Guy H. Hall Will Direct Work of Tractor Bureau

CHICAGO, April 15—The Power Farming Bureau, which was organized more than a year ago to promote publicity in behalf of tractors, has been succeeded by the National Institute of Progressive Farming. Guy H. Hall, best known to the tractor industry as secretary of the Kansas City Tractor Club and manager of the tractor shows held in Kansas City, is manager of the new organization.

The headquarters of the new organization will be in Chicago. It is supported by tractor and farm implement manufacturers and by organizations supporting progressive and diversified farming movements. The several cattle associations are for the first time joining with the manufacturers for a general advancement of the better farming idea. The plan is that the information developed and broadcasted by this organization will be constructive for farming and not in any sense the ordinary publicity type.

Packard Announces Its New Single Six

Produced in Two Wheelbase
Lengths to Suit Different
Body Types

DETROIT, April 20—The Packard Motor Car Co. released for publication today details of the new single six model which was announced in AUTOMOTIVE INDUSTRIES of February 9. The new model is now being produced in two wheelbase lengths to suit different types of bodies. The 5-passenger phaeton, 2-passenger runabout, 5-passenger sedan, 4-passenger coupe and 4-passenger sport models are mounted on 126 in. wheelbase chassis. The 7-passenger phaeton, 7-passenger sedan and 7-passenger limousine are mounted on 133 in. wheelbase. The prices are based on a list of \$2,650 for the 5-passenger phaeton and \$2,685 for the 7-passenger phaeton.

Mechanically, there is but little change as compared with the previous single six. In order to take care of the heavier bodies and to provide a standard engine for both wheelbases, one-half inch has been added to the stroke, making the dimensions for the power plant now three and three-eighths by five inches. Another slight change is the addition of one driving plate to the disk clutch, making this now a four driving plate type instead of three.

The bodies are characterized by long, low lines, accentuated by a bead strip which runs from the radiator around the entire length of the body and hood.

On the 5-passenger phaeton the tool compartment is in a space behind the front seat with curtains in left door pocket. On the 4-passenger sport, steel disk wheels are standard equipment. The tire equipment is cord 33 by 4½ in. on all except the sport model. Steel disk wheels are optional at \$35 additional.

List prices of the new single six, f.o.b. Detroit, are as follows:

5-passenger Phaeton	\$2,485
Runabout	2,485
Sport Model	2,650
Coupe	3,175
5-passenger Sedan	3,275
7-passenger Phaeton	2,685
7-passenger Sedan	3,525
7-passenger Sedan Limousine	3,575
"126" Chassis	2,250
"133" Chassis	2,350

These prices do not include freight or war taxes.

MANY AIRPLANES ENTER MEET

NEW YORK, April 18—More than 60 airplanes have been entered in the first of the national flying meets sanctioned by the Aero Club of America and the Aeronautical Chamber of Commerce, which will be held at Curtis Field, Garden City, Sunday, April 30.

PATENT CLAIM SETTLED

CLEVELAND, April 18—A claim of patent infringement against the General

Motors Corp. has been settled by Frank A. Scott, receiver for the Standard Parts Co. By the terms of the settlement, the corporation has taken a license under patents Nos. 1,153,481 and 1,153,482, dated Sept. 14, 1915, relating to rims, and has paid approximately \$25,000 for past infringement, this amount having been offset against the claim of the corporation against the estate of Standard Parts. It was contended by the Standard Parts Co. that the Jaxon Steel Products Co., a General Motors subsidiary, infringed the patents.

Monroe Incorporates with \$500,000 Capital

INDIANAPOLIS, April 15—The reorganized Monroe Automobile Co. of Indianapolis has filed articles of incorporation here with capitalization placed at \$500,000. The directors are William Small, J. H. O'Brien, F. A. King, J. F. Martin, and H. H. Alexander. Small is president and general manager; O'Brien, vice-president and executive manager, and Alexander is to be sales manager.

The plan is to sell direct to owners. Manufacture is to be continued at the old plant in this city, and the executive offices will remain at the same place. The company succeeds the William Small Co., which was sold at receiver's sale some time ago. Pending the reorganization the concern has been operating on the plan to be followed now.

Two Sections of S. A. E. to Hold Joint Meeting

NEW YORK, April 17—The Metropolitan and New England sections of the Society of Automotive Engineers will meet jointly at New Haven on April 21, when a paper will be presented by Prof. E. H. Lockwood of Yale University on "Power Losses from the Engine to the Road." The members of the Metropolitan section will go to the meeting in gasoline engine railway motor cars over the New York, New Haven & Hartford railroad.

On the same evening the Cleveland section of the society will discuss the matter of motor vehicle lighting, the paper of the evening being presented by H. H. Magdsick.

William F. Parish will discuss the dilution of crankcase oil at the meeting of the Detroit section on April 21, and will demonstrate a device to distill off the gasoline in the lubricating oil.

On April 27 C. T. Myers will read a paper before the Pennsylvania section, giving some notes on motor trucks.

PETERS MOVING TO NEW PLANT

BETHLEHEM, PA., April 17—The Peters Autocar Co., which has taken over the building formerly occupied by the Bethlehem Paper Co., is making rapid progress in transferring its equipment from the old plant at Trenton. The company is negotiating for the purchase of fifteen acres of land adjoining the building to provide for future expansion

Ford to Sell Truck Equipped with Body

"Three in One" Will Be Adapted
to Several Uses—3-Ton
Model Likely

DETROIT, April 18—The Ford Motor Co. will begin late in the summer to supply its one-ton truck, equipped with body complete, as well as the stripped chassis. The design of the body has not yet been definitely determined, but it will be a combination type practical for several uses. "Three in one" is the way one factory official described it.

It is probable Ford will enter the three-ton truck field late in the summer. This is dependent largely upon the development of business generally up to that time and the consequent probable demand for trucks. The company has mapped out definite plans to go into the heavy truck field, but they have been delayed temporarily.

Models of GMC Truck Made in Two Wheelbases

PONTIAC, MICH., April 15—The 2, 3½ and 5-ton GMC trucks are now being made in two wheelbases, the standard length models being designated as A and the longer models as B. The other chassis details remain as before, except for changes necessary to the longer construction. The prices of the models are:

Model	Wheelbase	Price	Capacity
K16	Standard	\$1,495	1-ton
K41A	Standard	2,775	2-tons
K41B	Long	2,775	2-tons
K71A	Standard	3,950	3½-tons
K71B	Long	4,050	3½-tons
K101A	Standard	4,350	5-tons
K101B	Long	4,450	5-tons

KREBS-COLLIER TRUCK

BELLEVUE, OHIO, April 17—A line of trucks to be known as the Krebs-Collier will be built by the Collier Motor Truck Co. for the Krebs Motor Truck Co. The capacity and prices of the new models follow: ¾-ton, \$1,260; 1-ton, \$1,565; 1½-ton, \$2,125; 2½-ton, \$2,375; 3½-ton, \$2,975.

BRINGING OUT NEW TRUCKS

CEDAR RAPIDS, IOWA, April 15—The Beck-Hawkeye Truck Works is bringing out two new models, a 2-ton C-40 to sell at \$2,150 and a 2½-ton D-50 to sell at \$2,850.

PRIVATE OWNERSHIP IN RUSSIA

NEW YORK, April 17—A dispatch from Moscow says the Council of Commissars has restored the right of private ownership of automobiles in Russia, and it is announced that the importation of motor vehicles and accessories will be permitted through the Foreign Trade Commissariat.

Creditors to Handle Assets of Owen Tire

**During Stormy Meeting They
Elect Attorney as Trustee to
Supersede Receiver**

CLEVELAND, April 15—Creditors of the Owen Tire & Rubber Co., at one of the stormiest meetings of claimants ever held in this city, took charge of the assets of the corporation, which came into existence here during the hectic days of the war.

The creditors elected Charles Higley, an attorney-at-law, trustee, and authorized him to take charge of the plant. M. M. Scott, who has been acting as receiver, filed his final report and was superseded by Higley.

There came into the meeting, which originally was scheduled to be held in the office of C. D. Friebolin, referee in bankruptcy, men and women to the number of 200. The meeting had to be adjourned to the old court house to accommodate the crowd. Among them were men and women whose life savings had been wiped out. They had drawn their savings from the bank and invested in stock of the company with the conviction that it would double and possibly treble, as everything was soaring in those days.

Dream of Wealth Gone

Their dream of wealth was shattered when the plant was closed down, but that shock was nothing like the one received at the meeting of creditors, to which many of these stockholders came.

This is what they learned: Men and women in Cleveland and northern Ohio had purchased approximately \$2,250,000 worth of stock. To-day the assets of the company consist of the plant and its machinery, worth possibly \$400,000. There are a number of suits pending in Common Pleas Court against officers and directors in which approximately \$300,000 is asked to be returned to the company. These suits set forth a story of large sums paid out as dividends when the company was not earning a surplus; of architects fees paid an officer of the company; of real estate belonging to the corporation that was taken over by officers of the corporation, and of extravagances practiced during the short time the plant was in operation and stock was being sold.

Against the plant and its machinery and the amount that may be realized from the pending suits, creditors at the meeting presented claims totaling \$900,000.

TORBENSEN AXLE REORGANIZED

CLEVELAND, April 17—Reorganization of the Torbensen Axle Co. has been carried through by J. O. Eaton, its former president and general manager, backed by Cleveland financial interests which acquired the interest of the Republic Motor Truck Co. in the axle cor-

YELLOW MAY REPLACE RED FOR TAIL LIGHT

NEW YORK, April 18—A bulletin sent out by the Society of Automotive Engineers states that serious consideration is being given to the advisability of using yellow instead of red tail lights to minimize the danger of motorists confusing with tail lights the lights placed along highways to indicate dangerous road conditions. This is held to be the cause of many accidents.

poration. Under the reorganization plan the company will have 80,000 shares of common stock of no par value, which will be exchanged for the former Torbensen preferred stock on the basis of four shares of the new common for one of the old. A block of the common has been underwritten to provide working capital.

United Auto Stores Assets Ordered Sold

PHILADELPHIA, April 15—Public sales of the assets in the stores of the United Auto Stores, Inc., located in the eastern district of Pennsylvania, have been ordered by United States District Judge Thompson. Application for the sales was made several weeks ago, but the court took the matter under advisement on account of pleas of the stockholders for a postponement until they should have time to consider a proposition for reorganization.

While Judge Thompson's order applies only to the assets in this district, similar orders will be sought in the Federal courts in those districts where the other stores of the concern are located. Francis F. Burch and Samuel A. Whitaker, receivers in equity, asked for the sale on the ground that every one of the stores was losing money in operations, and that unless a public sale were ordered at once, the assets practically would be consumed by accumulations of rent.

The merchandise assets in the 58 stores the company maintained were inventoried as of Dec. 31, last, at a valuation of \$221,000, while the fixtures cost the company \$1,000 for each store.

NEW CHASSIS SPRING

SPOKANE, WASH., April 15—A new type of chassis spring without center bolt has been invented by F. J. Laher of the Laher Auto Spring Co. of this city. Laher welds side clips to the leaves to hold them together, this welding being done by the electric arc process. The side clips naturally prevent the leaves from shifting laterally, but it was also found that, although no center bolt is used, there is no need for humps or other substitute methods to prevent endwise shifting of the leaves.

Will Sign Barnsdall As New Fuel Licensee

**Contract Involving Ramage Process to Be Entered Into
with Syndicate**

DETROIT, April 15—Contracts will be signed this week between the Chemical Research Syndicate, Ltd., headed by F. F. Beall, vice-president of Gray Motors Corp., and the Barnsdall Corp. of New York, by which the latter company will become the sole licensee in the United States and Mexico of the hydrogenation process perfected by Dr. A. S. Ramage, by which low grade fuel oils may be converted into motor spirit.

The Barnsdall Corp. has been testing the Ramage process for over a year to decide its commercial possibilities. Its recent annual report indicates an average yield of 70 per cent of motor spirit from the semi-waste oil products.

Under the contract to be signed, the interests of the automotive industry will be fully protected as to minimum supply of the new fuel to be produced, Beall said. Though the Barnsdall company will be sole licensee it will be empowered to license other companies, and will do so where its own facilities are inadequate.

Leading members of the Chemical Research Syndicate, Ltd., besides Beall, are J. B. Weaver, vice-president of the Pullman Co., Chicago; Benjamin Briscoe, former president of Briscoe Motor Corp.; Dr. Ramage, inventor of the process; H. H. Emmons, Detroit attorney, and Rudolph Stahl of Briscoe & Stahl, consulting engineers.

The offices of the syndicate will be continued in Detroit where research work and experimentation will be continued by Dr. Ramage in semi-waste oil products.

New Obenberger Forge Works on Organization

MILWAUKEE, April 17—The Obenberger Forge Co. of West Allis, Milwaukee County, has been incorporated with a capital stock of \$250,000 by the secured creditors of the defunct John Obenberger Forge Co. of Milwaukee, who recently purchased the entire assets, appraised at \$980,000, for \$48,000 in cash and assumption of secured claims amounting of \$188,000.

The new corporation is perfecting its organization with a view to resuming immediately the operation of the big drop forge works at West Allis. The incorporators include L. J. Klug of Klug & Smith, consulting and contracting engineers; B. A. Stenz and B. Hoffmann, Jr., head of the B. Hoffmann Manufacturing Co., all of Milwaukee.

FRENCH TO SHOW AIRCRAFT

NEW YORK, April 15—At its last meeting the French Syndicated Chamber of Aeronautical Industries decided to hold an aircraft show this year.

Casing Production Gains Over Last Year

Shipments Also Increase—Lower Inventories Carried Except of Inner Tubes

NEW YORK, April 18—Statistics of the rubber industry for the first two months of the year as compared with the same period in 1921 show a very material increase in production of pneumatic casings, inner tubes and tires.

Notwithstanding this fact, inventories for both months were considerably less except in the case of inner tubes, which show stocks on hand at the end of February larger than at the close of either January or February, 1921. Shipments were materially larger, but the gain was not so great in comparison with last year as in the production field. Tire production for the first two months of the year was running at the rate of more than 24,000,000 per annum.

Details for the two months of 1921 and 1922 follow:

PNEUMATIC CASINGS

	Inventory	Production	Shipments
1921—			
Jan.	5,319,605	703,430	965,417
Feb.	5,193,018	819,892	1,073,756
1922—			
Jan.	4,174,000	2,055,000	1,597,000
Feb.	4,691,000	2,084,000	1,562,000

INNER TUBES

	Inventory	Production	Shipments
1921—			
Jan.	5,556,163	740,824	1,042,617
Feb.	5,415,464	916,627	1,129,881
1922—			
Jan.	5,247,000	2,343,000	1,890,000
Feb.	6,142,000	2,597,000	1,703,000

SOLID TIRES

	Inventory	Production	Shipments
1921—			
Jan.	303,753	21,220	29,116
Feb.	304,374	23,365	29,599
1922—			
Jan.	182,000	40,000	33,000
Feb.	183,000	39,000	37,000

"Production" and "Shipments" figures cover the entire month for which each report is made. "Inventory" is reported as of the last day of each month.

"Inventory" includes tires and tubes constituting domestic work in factory and in transit to, or at warehouses, branches (if any), or in possession of dealers on consignment basis, and as a total represents all tires and tubes still owned by manufacturers as a domestic stock.

"Shipments" includes only stock forwarded to a purchaser and does not include stock forwarded to a warehouse, branch, or on a consignment basis, or abroad.

Durant and Gray Start to Add to Factory Space

DETROIT, April 15—Two large additions to existing motor car plants were put under way this week when the Durant Motor Co. broke ground for an addition to its Lansing factory which will give it a capacity of 400 cars daily for the Star car, and the Gray Motor Corp. signed contracts for the building of an assembly structure on its Detroit site with a capacity of about 200 cars a day.

Manufacture of the Star car will start at the Lansing plant in the present buildings during May. The first shipments of the Gray car have been fixed for May 15. Manufacture of engines for

CALL FOR FARM HELP GREATER THAN SUPPLY

MILWAUKEE, April 17—For the first time in nearly two years, the demand for farm help in Wisconsin is in excess of the supply, according to a statement issued by R. G. Knutson, state director of the Federal employment service in Wisconsin.

This condition strikes the manufacturers, distributors and dealers in farm operating equipment of all descriptions as probably the most encouraging they have heard about since the slump in prices of farm products generally induced a sharp depression in equipment sales.

During the latter part of 1920, all through 1921 and until a few weeks ago, farmers in Wisconsin maintained that they could get all the manual assistance they wanted without resorting to mechanical economies.

the Star car is now under way in the Continental Motor Corp. factory at Muskegon, and manufacture of engines for the Gray car is under way at the Gray engine plant, Detroit.

Contracts have been signed with the Auto Body Co. of Lansing for the manufacture of the open car bodies for Star cars made in the Lansing plant. In addition to its Star car capacity, the Lansing plant will have capacity for 200 Durant four-cylinder cars daily.

Tentative Plans Drawn for Bus Standardization

NEW YORK, April 17—The Engineering Committee of the American Electric Railway Association has drawn up tentative plans for standard motor bus construction. Proposed dimensions for the three sizes of chassis are:

No. of passengers.....	21	25	29
Wheelbase (inches).....	156	176	196
Engine (horsepower).....	30	40	50
Tread, front and rear (in.)..	66	66	66
Capacity of rear (tons).....	2	2½	3
Braking surface (sq. in.)....	150	175	200
Approx. maximum weight (lb.)	4500	5000	5500

Other recommendations are:

- Low-hung type of chassis frame with a maximum frame height of 26 inches, preferably lower.
- Spring suspension.
- Engine preferably of either poppet or sleeve valve type with maximum speed not to exceed 1300 r.p.m.
- Gear ratio not to be less than 7 to 1 and not more than 12 to 1.
- Metal plate or spoke wheels.
- 34-inch solid or semi-solid tires; pneumatics where low floor height not desired.

TAX YIELDS \$1,057,767

HARRISBURG, April 15—The State of Pennsylvania has realized \$1,057,767 from gasoline taxes during the first six months of enforcement of the new tax.

To Plan Year's Work at Aviation Meeting

Development of Type of Engine Eliminating Fire Hazard Will Be Discussed

WASHINGTON, April 19—A program for aeronautical research and development for the coming year will be considered by the members of the National Advisory Committee for Aeronautics at its semi-annual meeting to be held in the Navy Building to-morrow afternoon, April 20.

The committee, which is headed by Dr. Charles D. Walcott, is composed of independent and governmental scientists and engineers. The scientific research and development undertaken during the past year in both civil and military aviation will be reviewed. Problems of airplane wing design, new developments in aeronautical engines, methods of testing airplanes, wings and parts, airship studies, lifting gases, aerial routes, the air mail service, and problems for the advancement of commercial aviation are among the subjects to be discussed.

Dr. Joseph S. Ames, chairman of the executive committee, will outline the future plans of the committee with a view to placing America "foremost" in the development of aviation, as President Harding has recommended to the Congress.

The development of a new type of aircraft engine with a view of eliminating the fire hazard by the use of heavy fuel oil in place of gasoline, will be among the subjects discussed. Special studies and tests of a new high-speed airplane wing, believed to be of great value in the interests of military scout planes, will be recounted by Dr. Ames.

Commercial Aviation Bill Is Introduced in House

WASHINGTON, April 17—Representative Steenerson has introduced in the House a bill designed to encourage commercial aviation and authorizing the Postmaster General to contract for air mail service.

It prescribes rates of transportation and postage. The postage rate, under the bill, would be not less than 6 cents per oz. or fraction thereof. The Postmaster General would be authorized to contract with any individual, firm or corporation for the transportation of air mail at a rate not exceeding two mills per lb. per mile, and to contract either for the transportation by aircraft of first class mail other than air mail at a rate not exceeding ½ mill per lb. per mile.

A similar bill offered by Representative Kelly of Pennsylvania would fix the rate of payment for transportation by air mail at 1 mill per lb. per mile. Both measures have been referred to the Committee on Post Office and Post Roads.

Seeks to Minimize Acute Unemployment

Conference at Washington Shows Work Done by Chamber of Commerce

WASHINGTON, April 14—Manufacturers, trade association executives and members of the national conference of Business Paper Editors met yesterday with Secretary of Commerce Hoover, to discuss means of collecting and disseminating information intended to prevent or minimize the periodic recurrence of depressions and acute conditions of unemployment.

The meeting was in charge of Joseph H. Defrees, president of the United States Chamber of Commerce, assisted by Dr. Wesley C. Mitchell, director of the Bureau of Economic Research of the Department of Commerce. Representatives of the N. A. C. C. and M. & A. M. A. and the Rubber Association of America were present. Dr. Mitchell's bureau is working with a special committee of the Chamber of Commerce to collect unemployment information.

Dr. Mitchell explained that it was hoped to prepare a study which would contribute to trade stabilization of production, by finding out how some manufacturers have done this and by analyzing this information and putting it before manufacturers generally in a form which they could apply to their own problems. Dr. Mitchell said that the further fact that some manufacturers had been able to avoid sharp curves in the employment situation indicated that others probably had done the same thing.

Data to Be Analyzed

It was the object of the investigation, he said, to search out all such instances possible and to assemble and analyze comparable data on the subject. Among other things he said the Russell Sage foundation had been asked to assist in getting up a better system for reporting unemployment statistics.

During the discussion it developed that some progress already had been made in obtaining information on suitable methods of some manufacturers and on learning the effect of their policies on production, sales, inventories, employment, costs, etc.

The bureau hopes by fall to present a report on its investigation, and in the meantime wants all the assistance available from trade associations and individual manufacturers and wholesalers on means of getting the desired information and on methods of popularizing the study so that practical use can be made of it when it is complete.

EMPLOYMENT RECORD FOR YEAR

DETROIT, April 17—The Employers' Association has reported an increase of 4345 in total employment for the week and a decrease of 14,113 in the number of men working part time. The net gain

is 321,464 payroll hours over last week and establishes a new high record for the year. Of the 79 members of the association, only eight shops are on a part time basis. Total employment of the organization amounts to 140,734, compared with 96,000 during the corresponding week last year and 198,000 during the same week of 1920.

Racine Factory Feeling Skilled Labor Shortage

RACINE, WIS., April 17—For the first time in about a year and a half a manufacturing industry here has experienced the sensation of being unable to enlarge its operations because of the lack of skilled workmen. The industry is the H. & M. Body Corp., owned jointly by Hupp and Mitchell. It is seeking enough men to put on a full night shift, thus bringing up its output of open and closed bodies by 65 or 75 per cent. It has orders on its books to keep the plant busy at capacity more than eight months.

Other members of the automotive industry in Racine are experiencing a growing patronage, which is forcing extension of working schedules and forces. The Mitchell Motors Co. has increased its output by 25 to 30 cars a day within the past week by adding 200 men to its payroll, now in excess of 850.

Foundries and machine shops in Racine catering to automotive and agricultural equipment manufacturers are averaging 75 to 85 per cent of normal in operations. The tractor business is slowly but steadily advancing to the point where new production on a fair scale is in sight.

Exports from Germany Show Big Drop in 1921

WASHINGTON, April 18—Automobile exports from Germany during 1921, totaling 8840 motor vehicles, show a big drop, compared with the previous year, when 17,534 automobiles were exported, according to figures received by the automotive section of the Department of Commerce.

The exports were to the following countries, in the order named: Holland, Sweden, Spain, Belgium and Denmark. The exports of the last three months of 1921 were the only ones to show an increase as a consequence of the Berlin Motor Show.

GRANT TO IMPROVE POSITION

CLEVELAND, April 18—The Grant Motor Car Corp. has sent a letter to its stockholders informing them that negotiations are well under way whereby the company's financial status will be materially improved by the sale of its interest in the H. J. Walker Co., which manufactures engines. A full report of this transaction will be sent out later. The usual statement of the company's affairs for the year has been delayed because the annual audit has not been completed.

Ireland Will Offer Big Market for Cars

Demand Estimated at 30,000, Mostly Low Priced Products, Following June Elections

DETROIT, April 17—Ireland will be in the market for 30,000 motor cars a year following the establishment of its government in the June elections, according to Harry B. Huet, one of the big distributors of that country who is in the United States on a buying trip. Huet has acquired the sole sales rights in Ireland for the Gray car and the Seiberling tire.

Most of the Irish demand will be for cars in the low price field, owing to high costs of upkeep and the inherent economy of the people, he said, with only a scattering of business in the higher price classes. Price is the biggest consideration, and with high import duties and high ocean freights only cars in the low price fields can reach the big market.

Money is plentiful in Ireland, Huet said, but is not in great circulation as yet, owing to the recent troublous period, but the markets are gradually opening. Since 1916 products have commanded high prices which latterly have diminished to a certain extent, but are still yielding a large return. This is especially true of the farm products of the South.

Poor Railroad Service

The truck market is very good because the country is poorly served by its railroads, he said. There are plenty of good roads, and a start has been made toward the construction of more highways and better ones by the appropriation of more than \$1,500,000 for this work to begin at once.

Huet said he represented only one of many hundreds of dealers who will soon be in America looking for sales rights in Ireland. There is a warm feeling in Ireland for American products, he said, and where prices can be met there should be a large demand.

Tractors are in small demand, Huet declared, because the farms are for the most part too small to warrant their use, and, also, that the Irish farmer is not a mechanic and unable to keep his machine in constant use. Serious strides are being made by the Ford interests to educate the populace in the use of the tractors, but with indifferent success thus far, he said.

Huet estimated the total number of registered cars in Ireland to-day at approximately 60,000, practically all of which have come in since 1914.

CHARLES F. MOLLEY DEAD

READING, PA., April 18—The American Boron Products Co., Inc., makers of copper alloy metals, announces the death of Charles F. Molley, its vice-president and general manager.

Durant Again Asked to Buy Willys Plant

Offer Made to Pay \$4,000,000 in Notes for Corporation's Elizabeth Property

TOLEDO, April 19—Frank P. Kennison, one of the receivers of the Willys Corp., said to-day that the receivers and attorneys had again been in communication with W. C. Durant in an effort to persuade him to take over the Elizabeth, N. J., plant. The proposal made was to accept in payment \$4,000,000 in notes. The cost of the plant was approximately \$10,000,000.

"We have been at work on plans to provide for the liquidation of the assets of the corporation over a period of time and thus avoid any forced sale," Kennison said.

It is believed this is the reason for the recent advance in the price of the first preferred stock. The New Jersey Federal court has decreed that the sale of the Elizabeth plant shall be made in 60 days. Durant is the only possible purchaser considered seriously thus far.

It has been agreed that the Federal court in Toledo shall be the center for the legal entanglement for the Willys Corp., but the bankruptcy suit filed in New York will have to be cleared away first.

There was a Willys Corp. "field day" in court here yesterday. Attorney Joseph P. Cotton appeared for the first preferred stockholders' committee, E. Bisbee for the bank creditors' committee, Col. J. M. Hatfield for the merchandise creditors' committee and D. H. Miller, Thomas Tracy and E. J. Marshall for the Ohio receivers.

All the committees, with the exception of the bank creditors, have approved the sale of the Electric Auto-Lite Division, including the Toledo and Fostoria plants, at the upset price of \$4,500,000. Bisbee said he would have to have authorization from his committee before he could approve the move. The Federal tax claim against the corporation stands in the way, in his opinion, and should be determined first.

Claims Total \$24,000,000

TOLEDO, April 13 — That claims against the Willys Corp. will total more than \$24,000,000, but that only \$12,000,000 will be admitted as valid, was stated in a motion filed by attorneys for the Ohio Savings Bank & Trust Co. here asking for the sale of the Electric Auto-Lite division to pay valid claims. The motion filed was accompanied by an inventory of the Electric Auto-Lite division signed by the three receivers, Frank P. Kennison, C. O. Miniger and F. G. Caffey.

This inventory shows that the property of the Auto-Lite Corp. is worth about \$4,210,000, divided as follows:

Total factory inventory of the Toledo plant, \$2,137,425.71; land, \$125,793; buildings and equipment, \$509,821.34;

machinery and equipment, \$1,200,550; furniture and fixtures, \$38,663.26; Willys light division, \$18,098.64.

The report says there should be deducted \$564,228.43 for depreciation, leaving a total of \$1,696,915.47 as the present value of the property inventory.

The value of the Fostoria plant is given as \$209,817.28 and that of plant number six as \$167,943.68.

Auto-Lite Business Satisfactory

"In order to pay the valid claims, it will be necessary to sell the property in the Toledo federal district," the motion says.

It is stated that the Auto-Lite has been conducted practically as a separate concern. Business is reported very satisfactory.

There are 30 acres with factories and equipment near Poughkeepsie, N. Y., which parcel of the Willys Corp. is considered an integral part of the Auto-Lite and the motion recommends that this be sold also. Consent of the New York Federal court jurisdiction would have to be obtained.

Gary Assets Bought; New Company Formed

GARY, IND., April 18—The assets of the Gary Motor Truck Co., which has been in receivership for several months, have been purchased by Frank Dawson and three associates, who will reorganize the corporation under the name Gary Motor Corp., with a capital of \$1,000,000. Dawson is president and general manager of the new company. He also headed the old company.

T. H. Cooper, who was Kansas City distributor for Gary trucks, is secretary and treasurer; John Griffin is vice president, and Harry Searle is the fourth director. The property was purchased at trustee's sale for \$110,000.

Dawson announced that the company would continue the same line of trucks that the old company manufactured, at reduced retail prices, and would add a light delivery truck to be sold at a popular price. Following the sale, the factory was reopened and a number of men put to work. It is planned to distribute the trucks through branches to be opened in the larger cities.

The schedule of prices is as follows:

Model	Old Price	New Price
F 1½-ton.....	\$2,600	\$1,675
I 2-ton.....	2,900	2,150
J 2½-ton.....	3,800	2,550
K 3½-ton.....	4,900	3,550
M 5-ton.....	5,900	4,000

REORGANIZING LOCOMOBILE

NEW YORK, April 19—Bank creditors of the Locomobile Co., now in receivership, are understood to be working out a plan for the reorganization of the corporation. Merchandise creditors will be permitted to come in under the plan on the same terms as the bank creditors. The demand for Locomobiles now is said to be large enough to justify reorganization.

Bid for Bethlehem Regarded Inadequate

Merchandise Creditors Will File Objection to Confirmation of Sale for \$550,000

NEW YORK, April 19—Representatives of the merchandise creditors of the Bethlehem Motors Corp. will file in Federal Court at Philadelphia objection to confirmation of the sale yesterday by the receiver of the assets of that corporation on the ground that the high bid for the property was inadequate.

The high bid for the assets was made by Howard B. Hall of this city, formerly vice-president of the corporation, who offered \$550,000 for all the real estate and personal property both at Allentown and Pottstown, Pa. The only other bid was that of the Creditors' Syndicate Committee which offered \$540,000. Hall's bid was made in behalf of himself and other former officers, including Arthur T. Murray, who was president prior to the receivership and now is president of the American Bosch Magneto Corp.

In a recent letter sent to creditors by Murray and Hall, it was stated that they had a plan to rehabilitate the company and resume operations. The letter stated that if claims were assigned to "outsiders," the creditors would "simply afford an opportunity to junk the property and to make a profit on the claims held so long and doubtless prevent a reorganization and continuance of the business."

Kern Reported Interested

It has been reported that Martin E. Kern, who organized the company and whose purchase of the American Bosch Magneto interests from the alien property custodian is now being investigated by the Department of Justice, has been associated with Murray and Hall in their reorganization plan.

The creditors' syndicate committee represented the Chase National Bank and other banking interests which propose to take over the assets.

The upset price fixed by the court for the property was \$450,000, but the assets have been appraised at \$2,400,000. Merchandise creditors have contended that a bid of \$600,000 should be the minimum accepted by the court. It is understood that if Hall's bid is refused there is a possibility of a reorganization under conditions which will practically guarantee creditors an immediate payment of 10 per cent in cash and a very substantial interest in a new company.

When counsel for merchandise creditors requested Judge Dickinson, the special master, to postpone the sale set for yesterday, he declined to do so on the ground that a bid of at least \$600,000 would be made by certain interests connected with the old company. He consented, however, to extend the date of confirmation of the sale from April 24 to May 8.

Men of the Industry and What They Are Doing

Hohensee in Charge of Production

F. W. Hohensee, president of the Durant Motor Car Co. of New York, has been placed in general charge of production and engineering at the Long Island City, Lansing and Toronto plants of the Durant companies. Hohensee was one of the first executives to join forces with Durant and resigned as general manager of production for the Chevrolet Motor Co. to go with his former chief. He played an important part in getting the Long Island City plant into production in a remarkably short period.

Gallup Resigns from Marmon

David L. Gallup, for the last five years head of the division of research and experiment of the Nordyke & Marmon Co., has resigned, to take effect May 1. Gallup is well known in the industry and has been actively associated with the Society of Automotive Engineers, serving at one time as president of the Indiana section. Before entering the automotive industry at the Marmon plant, Gallup, for many years, was in charge of the automotive division of the Worcester, Mass., Institute of Technology.

Waterfall at Film Conference

Arthur T. Waterfall, vice-president of Dodge Brothers, has been named to represent the automotive industry at the Industrial Film Conference of the Committee on Motion Pictures, which will meet in New York on April 27. The committee will take up the work of drafting a report on the use of industrial films and their distribution, being the outgrowth of the recent industrial associations' conference with Secretary Hoover in Washington.

Rieman on Chicago Air Board

C. S. Rieman, president of the Elgin Motor Car Corp., has been appointed chairman of a committee of the Air Board of Chicago to co-operate with the Lincoln Park commissioners in laying out and developing an aircraft landing field.

Alford Elected a Councilman

Walter H. Alford, vice-president of the Nash Motors Co., has been elected a member of the Kenosha, Wis., city council for a two-year term.

Lount Is Cadillac Comptroller

H. J. Lount has been appointed comptroller of the Cadillac Motor Car Co. and has been succeeded as head of the factory accounting department by L. S. Carter. Lount has been with the company continuously since he began his association with it as a payroll auditor eighteen years ago. During the war he

was associated in accounting both as to automobile and aircraft production. He was made factory accountant August 1, 1918, a position he has held up to the present time.

Sonneborn in Charge of Branches

Arthur B. Sonneborn, vice-president of the American Electric Fusion Corp., will be in charge of branch offices of that company opened in the Dime Bank Building, Detroit, and covering the Ohio, Indiana, Western Pennsylvania and Michigan territory. Sonneborn was formerly sales manager of the Detroit Electric Welder Co. and the Federal Machine & Welder Co.

Sam Miles Goes to Europe

S. A. (Sam) Miles, veteran automobile show manager, sailed from New York Wednesday on the Carmania with Mrs. Miles for his annual trip to Europe. He will spend most of his time in England, but also will visit the Continent to study prospects abroad for the sale of American motor vehicles and equipment. He expects to return some time in June.

Martin Now with Denman Tire

H. J. Martin, former advertising manager of the export department of the Firestone Tire & Rubber Co., has become promotion manager of the Denman & Myers Cord Tire Co., with headquarters at Warren, Ohio.

Dill Made Sales Director

George W. Dill, for many years associated with the Dayton Airless Tire Co., has been appointed director of sales of the Essenkay Products Co., Chicago, manufacturers of Essenkay and ammonia gas tubes. Dill was formerly in charge of the mail sales division of the Dayton company and later served as sales manager, a position he retained until his resignation to become connected with the Essenkay organization.

Davis Heads Apperson Branch

J. F. Davis, for fourteen years head of the Chicago branch of the Winton Co., has taken over the management of the branch in that city of Apperson Bros. Automobile Co., and will launch an aggressive sales campaign. Re-establishment of the Apperson sales rooms on Michigan Avenue is the first major move made by Davis.

Dodd Represents Crowley

Theodore L. Dodd, Chicago, has been appointed western sales representative of the D. J. Crowley Co. of Detroit. In this capacity he will look after the sales of the Penn Seaboard Corp. of Philadelphia, the Tacony Steel Co. of Philadelphia and the Titusville Forge Co., of Titusville, Pa.

Will Direct GTD Sales

Edward Blake, Jr., vice-president of the Greenfield Tap & Die Corp., who has been manager of the corporation's drill plant at Taunton, Mass., has been appointed vice-president in charge of sales, and will make his headquarters in Greenfield. Blake served as vice-president and general manager of the Lincoln Twist Drill Co. at Taunton until its sale to the Greenfield corporation in 1920. Ralph Barstow, former general sales manager, has resigned to associate himself with Marquis Regan as counsellors in merchandising and marketing, with offices at 21 East Fortieth Street, New York City. Barstow went to Greenfield in July 1919, after serving as director of the department of selling and advertising in the A. E. F. university at Beaune, France. For two years he has been an instructor in sales methods for the Massachusetts state university extension.

Lee Tire Names Wilkinson

Tom H. Wilkinson has been appointed Pacific Coast representative of the Lee Tire & Rubber Co. He resigned as manager of the San Francisco branch of the United States Rubber Co. recently, after serving for a period of 17 years with that corporation. Wilkinson's earliest connection with the industry was with the old Hartford Rubber Works Co., which he represented in the San Francisco territory. At that time he was an associate of Harry E. Field, now general sales manager of the Lee company. When the Hartford Works was absorbed by the United States Rubber Co., Wilkinson was retained, and since that time has held important executive positions with the latter company.

Schwab Heads Sales at Ford Branch

P. W. Schwab, connected with sales at the Ford branch in New York for a number of years, has been made head of the department under the general direction of Gaston Plantiff, branch manager. W. A. Francis, whom he succeeds, has been made branch manager at Cincinnati.

Seiberling, Jr., Distributing Cars

C. W. Seiberling, Jr., son of the president of the Seiberling Tire & Rubber Co., will distribute Wills Sainte Claire cars in New Mexico, with headquarters at Sante Fe, as a result of a co-partnership between him and F. P. Weaver.

Dolan Joins Mack

James F. Dolan, former division superintendent of the Willys-Morrow plant at Elmira, N. Y., has been appointed to an executive position with Mack Trucks, Inc., at New Brunswick, N. J.

Plants Speeding Up in All Branches of the Industry

Yellow Cab Triples Output

CHICAGO, April 18—The production of the Yellow Cab Manufacturing Co. for April will be more than three times the production for April of last year. The output at this time last year was five or six cabs a day, and it is now 15 to 20 a day. The shipments in March were 350 cabs. Several departments of the factory, including mill and machine shops, are working day and night. More of the cabs are now going to New York than to any other city. Sales are 50 days ahead of production, orders now in hand being sufficient to keep the plant busy until well into June.

Hendee Adds to Force

SPRINGFIELD, MASS., April 18—Hendee Manufacturing Co. has added 200 to its plant force, bringing the number to 1200, and is producing 100 motorcycles daily. A further increase is projected on the strength of incoming orders that assure brisk business at the plant for months ahead. All departments are working full time, and several are working overtime. Export business is showing an improvement, along with a big gain in domestic sales.

Building More Engines

PONTIAC, MICH., April 18—The Wilson Foundry & Machine Co. has been increasing production on the Willys-Knight engine for the Willys-Overland plant in Toledo rapidly since the installation of the plant here. Production during the past week has approached 100 engines daily and efforts are now being made to advance it to 150 daily. This would call for capacity production on the line with the present shifts at work.

Bosch Force Will Number 2000

SPRINGFIELD, MASS., April 17—The American Bosch Magneto Corp. is operating with a force of 1200 in its plant here, and it is said the force will be brought to 2000 soon. A largely increased business is being done with the battery ignition system for the Ford, and a similar equipment for the Chevrolet is now being placed on the market.

Reo's Question One of Production

DETROIT, April 17—Reo production has reached a point, officials declare, where it is not a question of how many cars can be sold, but how many can be built. There is every indication, the company reports, that this increase in business will be extended over the year and will not merely be a spring revival.

Westinghouse Adds to Plant

SPRINGFIELD, MASS., April 15—Owing to a heavy increase of orders, the Westinghouse Electric & Manufacturing Co. has begun the erection of an additional factory building of one story,

TIRE FACTORIES ARE STEADILY MOVING FORWARD IN OUTPUT

AKRON, OHIO—Production has been increased from 22,000 tires a day to 24,000 daily by the Goodyear Tire & Rubber Co. following the employment of 1000 additional tire builders.

When Goodyear issued the call for 1000 men, it was the largest single labor call Akron had heard for many months. Goodyear started the year with an average production of 18,000 tires a day.

The Firestone Tire & Rubber Co. in the last five weeks has increased production from 18,000 to 21,000 tires daily.

SPRINGFIELD, MASS., April 18—New England Tire & Rubber Co. is establishing quantity production in its cord tire, and it is stated that carload lots are being shipped regularly to branches and dealer agencies. Sales Manager J. B. Cothran predicts that by summer the plant will be operating nearly at capacity.

525 x 85 ft., here, to be completed in six weeks. This will enable the company to take on 500 additional employees.

White Sees General Improvement

CLEVELAND, April 17—The White Co. has received reports from all its 40 branches indicating a decided improvement in general business conditions with every prospect for increased sales. The demand for motor trucks to operate on railroads continues. A few of the railroads now operating White trucks on rails are the LaCrosse & Southeastern; Minneapolis, Verde Tunnel & Smelter; Clarksdale, Ariz., & Mt. Hood; Hood River (Oregon) and the Tennessee Midland.

Moon 50 Per Cent Better

ST. LOUIS, April 17—The Moon Motor Car Co. reports that its sales for March were 50 per cent greater than for March 1921 and 20 per cent greater than for March 1920. The production schedule has been increased, and the company says it has enough orders on hand to maintain the present schedule until July 15.

Stewart-Warner Output Doubled

CHICAGO, April 17—The Stewart-Warner Speedometer Corp. has increased its production from 4200 to 5130 units a day and vacuum tank production from 4000 to 4800 units a day. This is double the production a year ago and compares favorably with the record output of the company.

Cadillac Has Record Business

DETROIT, April 17—The Cadillac Motor Car Co. reports that the first quarter of 1922 brought the best business in its history. Its foreign shipments have increased materially since Jan. 1. The increases range from 37 per cent to 651 per cent over the same period in 1921. The largest increases have come from Argentina with 213 per cent, Cuba with 315 per cent, Australia with 420 per cent and Holland with 651 per cent. Shipments have been made since January 1921 to 28 countries.

Gardner Increases Schedule

ST. LOUIS, April 15—The Gardner Motor Co., which originally announced a production schedule of 1500 cars for April, has increased the schedule to 2000 for this month and 2500 for May. A statement issued by W. H. Yeldell, sales manager, says that the company has in hand orders for more cars than it will be able to produce up to June 1. Almost equal parts of the Gardner production for the last few months have gone to the east and to the west of the Mississippi River.

Improvement with Preston

BIRMINGHAM, ALA., April 18—J. T. Driver, vice-president of the Preston Motor Corp., manufacturer of the Premocar, reports that orders have been placed in this city alone to assure steady production for several months. The company also notes improvement in the foreign trade—having shipped three of its phaeton models to New Zealand this week.

Dort to Build 2000 Cars in May

DETROIT, April 17—The Dort Motor Car Co. will increase its schedule to 2000 cars for May to meet increased business. The inventories of the company will be brought to a low figure by early summer under the impetus of present business, being worked down from a figure approximately \$2,000,000 a year ago.

Nash Reports Big Gain

KENOSHA, WIS., April 14—Nash Motors Co. reports an increase of more than 50 per cent in sales for the first quarter of 1922 as compared with the same period in 1921. There were on hand at the beginning of April delivery orders for 5025 four and six-cylinder cars as compared with 3307 at the same time last year.

Jordan Producing 40 Daily

CLEVELAND, April 14—Production at the factory of the Jordan Motor Car Co. has been increased to 40 cars a day, and it is expected the May output will be still larger.

Creditor Now Asks Kentucky Receiver

Suit Filed, Although Merger Plans Are Practically Completed

LOUISVILLE, KY., April 18—Two additional actions were filed yesterday to throw the Kentucky Wagon Manufacturing Co. into the hands of a receiver. At the same time it was learned that the committee seeking a merger with other companies in the Associated Motor Industries practically has completed all details and in a few days will announce the merger.

Both of the suits filed yesterday seek the appointment of a receiver to conduct the affairs of the company and also to consolidate the cases with two similar ones filed three weeks ago.

The Willard Storage Battery Co., plaintiff in one action, alleges that the company is indebted to it in the sum of \$5,000 in notes.

The plaintiffs in the other actions are Eva F. Churchill, Willa F. Whitlock, J. M. Rogers, J. J. Shelley and Mrs. Lotta Lee Peter, executrix of the estate of R. A. Peter, all of whom are stockholders seeking to preserve their interests and the interests of others similarly situated.

The suits filed separately three weeks ago have been consolidated, and some proof has been taken in the form of depositions to be used when the motion for a receiver is heard by Judge Davis W. Edwards at a date yet to be agreed on by the attorneys. Those named party defendants to all the actions are Robert V. Board, G. E. Glazebrook, J. C. Murphy, James R. Duffin, John W. Barr, S. E. Duncan and I. T. Axton, the committee seeking the merger with several other corporations in different sections of the country.

Predicts Unlimited Credit for Dealer

WASHINGTON, April 17—Credit facilities for automobile dealers this year will be virtually unlimited to the dealer who is worthy of credit, according to a statement made here to C. A. Vane, general manager of the National Automobile Dealers Association, by Governor W. D. G. Harding of the Federal Reserve Board.

Banks have plenty of money, Governor Harding said, and are anxious to lend it where it will be productive. "But this is a period of settling business," the governor went on, "and money in all lines will be available only to the man who is worthy of credit."

The governor expressed considerable interest in the new membership requirements of the N. A. D. A., and his questions made it plain that he believed the dealers were doing a thing that would make it much easier for them to establish proper credit facilities with their bankers.

Vane left here for New York, where he expects to conclude final arrangements for fire, theft and transportation insurance for "One of a Thousand" members of the association. Present negotiations indicate that a saving of substantially 40 per cent will be effected for this contents coverage, placed in one of the biggest old line stock insurance companies in the world.

Highway Traffic Body Prepares for Meeting

NEW YORK, April 17—Among the subjects listed for discussion at the annual meeting of the National Highway Traffic Association, which will be held at the Automobile Club of America in this city, May 12, are traffic safety regulations governing speeds, weights and dimensions of motor trucks and trailers, license fees and highway franchises.

The national chairmen who have been asked to make reports on the conference are:

Elmer Thompson, secretary, Automobile Club of America, on uniform highway signs; Herschel C. Smith, assistant professor of Highway Engineering, University of Michigan, on traffic capacity and widths of highways outside of municipalities; H. Eltinge Breed, consulting engineer, New York City, on the status of the construction of highway curves and recommended practices to increase traffic safety; F. W. Fenn, secretary national motor truck committee, National Automobile Chamber of Commerce, on highway transport franchises; Tom Snyder, secretary, National Association of Commercial Haulers, on highway transport clearing houses; George H. Pride, president, Heavy Haulage Co., New York City, on regulations governing speeds, weights and dimensions of motor trucks and trailers; and Henry G. Shirley, roads and sanitary engineer, Baltimore County Roads and Sewerage Department, on license fees and motor vehicle taxation.

ZEDER FINANCING PLANS

CLEVELAND, April 20—Plans have been completed for financing the manufacture of the new Zeder car, but await the approval of certain interests in this city and New York before they are made public. A prospectus for the new company has been prepared and will be submitted in a few days to the persons interested. The new car will be made in the plant of the Cleveland Tractor Co. in this city, and the capitalization of that company will be increased to provide the necessary capital.

PACKARD EXPECTS GOOD YEAR

NEW YORK, April 20—The financial statement of the Packard Motor Car Co. for the six months ended Feb. 28 showed a loss in factory operations of \$204,349 and through branch operations of \$570,198. It is expected, however, that the second six months of the fiscal year "will form a distinct contrast to the first, and that the year, as a whole, will prove a profitable one." Factory sales for the six months' period were \$13,687,739, and the cost of sales \$12,999,613. The balance sheet showed a net profit and loss surplus of \$14,631,706.

Templar Syndicate Deposits \$750,000

Funds Will Pay Off Creditors' Notes and Provide Work- ing Capital

CLEVELAND, April 18—The Templar syndicate of which M. F. Bramley, president of the Templar Motors Co.; J. C. Brooks, an attorney, and W. M. Patterson, a Cleveland business man, are managers, has deposited \$750,000 in the Guardian Savings & Trust Co. to pay off the notes of all creditors and to provide working capital for the Templar company.

It is announced that all outstanding notes and claims of all kinds will be paid and the balance of the funds will be used to carry on plant operations. Notices have been sent to all creditors of the company asking them to send their notes and claims to the Guardian Savings & Trust Co., this city. The bank will pay these liabilities.

The production of Templar is now on a basis of eight cars a day. The capacity is 25 cars a day. Business on the books indicates that May will be a better month than April for the company.

Midwest Tire Makers Report Bigger Output

CHICAGO, April 17—At the monthly meeting of the Midwest Rubber Association here several manufacturers reported noticeable increase in tire business, and one manufacturer said he was gradually increasing the price of his tires. About 30 members of the association and a number of guests attended the meeting, several western and midwestern cities being represented.

One manufacturer who a year ago last January made only 500 tires in the whole month said his production is now about 750 tires a day. Several others reported 24-hour operation with production of 1000 or more a day. One maker said his distributor at Atlanta, Ga., has sent in greatly increased orders in the last few weeks, and reported a business improvement of nearly 200 per cent in the last few weeks in that section of the south.

W. W. Wochter, president of the association, who conducts a tire manufacturing business at Omaha, Neb., said the business improvement was coming from the West and spreading toward the East.

LEE WILL ADDRESS MEETINGS

WASHINGTON, April 15—Gordon Lee, chief of the automotive division of the United States Bureau of Foreign and Domestic Commerce, will address automotive men in the far West in June and July. He will speak at the summer convention of the Automotive Equipment Association at Colorado Springs, then going on for the annual meeting of the Washington State Automotive Trade Association at Olympia, July 21 and 22.

Prices of Franklin Reach Lowest Mark

**Phaeton Now Listed at \$1,950—
Reductions Range from
\$450 to \$650**

SYRACUSE, April 17—Reductions ranging from \$450 to \$650 on its various models, effective immediately, are announced by the Franklin Automobile Co. The list follows:

	Old Price	New Price
Roadster	\$2,400	\$1,900
Phaeton	2,450	1,950
Demi-Coupe	2,750	2,100
Demi-Sedan	2,850	2,250
Victoria Coupe	3,200	2,750
Brougham	3,300	2,750
Sedan	3,450	2,850

This reduction brings the Franklin cars to the lowest prices in the history of the six-cylinder type extending as far back as 1906, with the single exception of a four months' period in 1916. The war price of the phaeton was \$3,100 and of the sedan \$4,350.

The Franklin company was the first to follow Ford in the price reductions which came when the period of deflation was well under way. The drastic cut made at that time brought a very substantial business. Increases of \$100 on its more popular models went into effect Feb. 1.

NEW TRIANGLE PRICES

ST. JOHNS, MICH., April 17—New prices are announced by the Triangle Motor Truck Co. on its four models. The list follows:

	Old Price	New Price
Model AA, 1-ton.....	\$1,385	\$1,285
Model A, 1½-ton.....	2,350	1,985
Model C, 2-ton.....	2,700	2,285
Model B, 2½-ton.....	2,950	2,585

PARKER TRUCK REDUCED

MILWAUKEE, April 17—Substantial price reductions are announced by the Parker Motor Truck Co. The list follows:

	Old Price	New Price
Model J 20, 3½-ton....	\$4,400	\$3,950
Model M 20, 5-ton.....	5,500	4,850
Model C 22, 1-ton.....		1,875
Model G 22, 2½-ton...		3,200

Model F20, 2-ton, will be discontinued.

WARD ELECTRIC REDUCTION

MT. VERNON, April 17—The Ward Motor Vehicle Co. announces price reductions ranging from 35 per cent to 40 per cent. The WS-2 model, ½-ton capacity, is now \$2,485, and the WA-2 model, ¾-ton capacity, is now \$3,295.

CHANGE IN SENECA PRICE

FOSTORIA, OHIO, April 17—The Seneca Motor Car Co. has reduced the price of its model M ½-ton truck from \$920 to \$820.

TEXAS MOTOR PLANT SOLD

FORT WORTH, TEX., April 19—The bid of the Moco Monkey Grip Rubber Co.

of Oklahoma City, boot and patch manufacturers, for the plant of the Texas Motor Car Association, has been accepted by the court which previously had named receivers for the association. Bankruptcy proceedings against the association were dismissed yesterday. The bid for the plant, which cost \$3,000,000, was \$295,000. The Oklahoma factory will be moved here.

General Motors Elects Directors to Vacancies

WILMINGTON, DEL., April 19—At the annual meeting of stockholders of General Motors Corp. held here to-day, the twenty-eight directors now constituting the board of directors were re-elected and the three existing vacancies were filled by the election of:

George M. Hannum, general manager of the Oakland Motor Car Co., a division of the corporation.

Alex B. C. Hardy, general manager of the Olds Motor Works, a division of the corporation.

Herbert H. Rice, general manager of the Cadillac Motor Car Co., a division of the corporation.

Organization meeting of directors for election of officers for the ensuing year will be held in New York at 3 p. m. Tuesday, April 25.

U. S. Rubber Co. Reports Substantial Gain in Sales

NEW YORK, April 19—Charles B. Seger, president of the United States Rubber Co., issued a statement following the annual meeting of stockholders yesterday in which he pointed out that the company's business generally showed a steady improvement since the close of 1921 and that the sales for the first quarter of 1922 were considered satisfactory. He said:

Tire business has shown substantial gain in unit sales over the corresponding period of last year and an increase in dollar volume of sales notwithstanding a lower level of prices compared with last year.

Trade conditions among tire dealers point to a substantial increase in demand over last year.

Newcomb Carlton, president of the Western Union Telegraph Co. was elected a director. The other directors were re-elected.

ATWATER KENT INCREASES

PHILADELPHIA, April 15—Demands of automobile manufacturers for electrical equipment have resulted in the Atwater Kent Manufacturing Co. increasing its output from 30 to 90 per cent of capacity within the last 60 days. A year ago the plant was on 40 per cent capacity and about 25 per cent four months ago.

GRAY & DAVIS GAINS

BOSTON, April 18—Gray & Davis, Inc., is feeling the full effects of the increase in automobile sales and reports that it is receiving a big volume of releases from all of its important customers.

Maibohm Plan Rests on Getting Simplex

**Latter Would Be Marketed Instead of Former—Bankers
Consider Bond Issue**

NEW YORK, April 19—Receiver's sale of the assets of the Maibohm Motors Co., which was scheduled for to-day at Sandusky, Ohio, was again postponed to give further opportunity for a reorganization of the company. A New York banking house is seriously considering a bond issue of \$500,000 and a stock issue of at least that amount, contingent upon the acquisition of the rights to manufacture the Simplex car, now owned by the Mercer Motors Co.

The reorganization plan is being promoted by H. C. Maibohm, who organized the Maibohm Motors Co., and it is understood he has obtained an option on the Simplex assets. If the plan goes through successfully it is understood that a new Simplex car will be placed on the market at a price radically less than that for which it formerly sold. The Maibohm will be discontinued but certain features of it may be included in the new Simplex, which will be produced in standard models at the Sandusky plant.

Simplex was operating as a separate entity when its sales were taken over with those of Mercer and Locomobile upon the organization of Hare's Motors. Prior to the dissolution of the contract with Hare's Motors, all the capital stock of the Simplex Automobile Co., Inc., was acquired by the Mercer company. Manufacture of the Simplex car has been discontinued.

\$9,188,561 Is Sought from Lincoln Motors

(Continued from page 884)

DETROIT, April 19—W. C. Leland, general manager of the Lincoln Motor Car Co., issued a statement to-day in which he said the suit of the government was wholly unexpected, as a complete settlement was regarded as having been made three years ago. Both W. C. Leland and his father, Henry M. Leland, will take the witness stand to deny charges of profiteering and to defend the rights of Lincoln creditors.

In his statement Leland said there was no justification whatever for the presentation of any claim on the part of the War Department. From the time a complete settlement was reached in the early part of 1919 until the last of February, he declared, no one had the slightest idea or intimation that the government had any intention of overturning the settlement, "which was fully and fairly made and in which the government was represented by many very able men."

He added that he and his father were very anxious to have the case heard in court as quickly as possible to prove the charges unfounded.

Graham Resolution Meets Bad Weather

Promises of Legislative Leaders Far from Fulfillment—Ob- jections to Overcome

WASHINGTON, April 19—It appears that promises of legislative leaders to protect American manufacturers and dealers against speculators in surplus army trucks originally sold the American Expeditionary Forces, as well as the British and French governments, are far from fulfillment.

Talks with senators and representatives showed that it would be necessary to eliminate objections among the minority to the consideration of the so-called Graham resolution, which would assess high tariffs on motor trucks, passenger cars and other surplus material re-imported and intended to compete with domestic products. It was believed that the Senate Finance Committee would incorporate a provision to this effect in the tariff bill, but the bill contains no such protection.

It is reported that senators on the committee felt that it would be possible to obtain quick action by rushing the passage of the Graham resolution, knowing that the tariff bill would be indefinitely delayed in the Senate and in conference, owing to the conflict as to valuation basis. The resolution has been called up several times at this session, but each time was tabled on the objection of various senators. The measure, as approved by the finance committee last year, would allow the speculators sufficient time to handle shipments after it became effective.

However, the Senate Finance Committee retained the provision of House tariff bill which levied the same internal tax on imported articles as assessed on domestic products. When the goods were shipped abroad, no internal taxes were paid on Government property.

Western Underwriters Urge Sterner Measures

CHICAGO, April 15—A conference to discuss means of reducing the number of automobile thefts throughout the country was held in Chicago this week by managers and representatives of the various automobile insurance theft bureaus and representatives of the Western Automobile Underwriters Conference.

The meeting was suggested some time ago by the national theft committee of the National Automobile Underwriters Conference. The opinion was held among those at the conference that automobile stealing will continue to increase until thieves are more severely punished than they have been in the past. There was considerable discussion of the Dyer Law which makes it a Federal offense to transport a stolen car from one state to another.

It was suggested that automobiles should be inspected by the state before licenses are issued, and that this would result in reducing the number of thefts. It was said that in many cases automobile thieves have been released upon payment of a light fine or after serving a short sentence. In many cases it was said the reluctance of the insurance companies to push the case against the automobile thief has resulted in turning loose countless numbers of automobile thieves.

FINANCIAL NOTES

General Tire & Rubber Co. has declared the regular quarterly dividend of 2 per cent on common stock payable May 1 to a stock of record April 20. The company on April 1 paid a 1½ per cent dividend on preferred stock. General was one of the few tire companies in the country which did not suspend dividend payments during the slump period.

American La France Fire Engine Co.'s report for the quarter ended March 31 shows net income amounting to \$196,049 before Federal taxes but after interest charges. This compared with net profits of \$183,950 in the corresponding period in 1921. The income account lists operating profit at \$205,217 against \$225,814 in the preceding year.

Grand Rapids Tire & Rubber Corp. announces the payment on April 1 of the regular 2 per cent quarterly dividend on preferred stock. The corporation has increased its distribution to a point where it is represented in every state in the country.

Franklin Automobile Co. has declared the regular quarterly dividend of 1½ per cent on preferred stock payable May 1 to stockholders of record April 20.

WIN LOCK PATENT SUIT

LOS ANGELES, April 15—The United States District Court here has granted an injunction and damages to the Miller-Chapman Co. of Los Angeles and the Security Manufacturing Co., manufacturers of the Red Security Auto Theft-signal, against the Los Angeles distributor of the Green Lock Co. of Detroit, Mich. The court decided the patent of the latter company an infringement.

LAMP SUIT DISMISSED

BALTIMORE, April 19—Judge Rose has handed down an opinion in the United States court dismissing the suit of August R. Gross against Joseph Frank for alleged infringement of a patent for a parking lamp for automobiles. Gross conducts a business as the General Machine & Specialty Co., and Frank as the Arjo Manufacturing Co. Both are located in Baltimore.

GOODRICH DIRECTORS RE-NAMED

NEW YORK, April 20—Directors of the B. F. Goodrich Co. were re-elected at the annual meeting of stockholders. The regular dividend on the preferred stock was declared at a meeting of directors which followed.

BANK CREDITS

Written exclusively for AUTOMOTIVE INDUSTRIES by the Guaranty Trust Co., second largest bank in America.

Last week's money market showed signs of continued ease. Call loans covered a range of 4 per cent to 4½ per cent, as compared with 4½ per cent to 5 per cent in the previous week, and on April 17 the ruling rate was 3½ per cent. An easier undertone was also apparent in the rates for fixed date funds. Toward the last of the week there was a decline to 4½ per cent for all periods of from sixty days to six months, as against 4½ per cent for sixty and ninety days and four months, and 4½ per cent to 4¾ per cent for five and six months' maturities in the previous week. The price commercial rate remained unchanged at 4½ per cent to 4¾ per cent.

A significant event in last week's money market was the offering of \$150,000,000 of United States Treasury Certificates at 3½ per cent. This is the lowest offering rate since September, 1917. The last previous offering on March 15, 1922, was at 4½ per cent. This, taken in conjunction with the lowering on April 13 of the Bank of England's discount rate to 4 per cent, strengthens the belief held in some quarters that a lower official rate may obtain in New York.

The Federal Reserve Bank of Richmond reduced its rediscount rate on all classes of paper from 5 per cent to 4½ per cent, effective April 14. Only three banks, the Dallas, Kansas City and Minneapolis institutions, now retain a 5 per cent uniform rate, the others having a 4½ per cent rate.

The foreign trade figures for March show exports at \$332,000,000, the highest amount since October, 1921, and imports at \$258,000,000, the greatest for any month since December, 1920. The export balance of \$74,000,000 compares with \$35,000,000 in February and \$135,000,000 in March, 1921, and is the largest favorable balance since November, 1921, when the excess of exports amounted to \$83,000,000.

Wholesale price indices for March show a decline, Dun's figures registering a decline of 2 per cent and Bradstreet's 6/10 of 1 per cent.

Staring to Manage New Walker Engine

CLEVELAND, April 20—The H. J. Walker Co., manufacturer of automobile engines, expects to announce in a few days completion of a plan for refinancing the company, by which it will have \$300,000 additional cash working capital. A \$390,000 common stock syndicate subscription was oversubscribed by \$40,000. W. H. Staring, who was formerly vice-president of the Peerless company, is to have the management of the Walker company. The syndicate taking charge of the refinancing is headed by the Krouse, Tremaine & Kulas Co.

Capacity of Truck Plants Seen by Fall

Production in Detroit District Is
Now Running Close to 50
Per Cent

DETROIT, April 18—Truck production in the leading factories of the district is now running close to 50 per cent of capacity with increases in business accumulating which promise capacity production by early fall with a gradual stepping-up throughout the summer. The demands run from 1-ton to 3-ton sizes. Most of the business is in the lighter vehicles, but with gradually increasing business in the heavier models.

Road work is responsible for most of the 3-ton sales at this time, these vehicles being equipped with pneumatics because of the greater traction offered on weak, yielding surfaces. Although most of the Government war trucks were allotted to state highway departments, it is found that these are being used mainly for maintenance and repair work.

Contractors on new roads are in the market for trucks. Building contractors in the cities are found to be turning to lighter models because of their greater responsiveness in heavy traffic. Some manufacturers of trucks are viewing with alarm the increased activity of highway officials in limiting loading capacity, but others regard this as something which will work out favorably for the truck industry as making for longer life of vehicles.

Reduced rates on automobiles carried on Detroit & Cleveland Navigation Co. boats are effective to-day. The open car rate is reduced 15 per cent and the closed 25 per cent. The new rates are practically the same as pre-war rates.

Car Business to Continue Heavy

DETROIT, April 19—Three factory conventions held in the Detroit district the past week have given indications of continued heavy absorption of automobiles for an indefinite period. These conventions were held by the Maxwell Motor Corp., the Reo Motor Car Co. and the Detroit Electric Car Co.

As nearly as can be estimated, the ratio of replacement and first car buying is about three to one. Reports from territorial men attending these conventions showed that dealers in most parts of the country are handling their replacement business in a way which permits quick turnover of the exchanged car at a profit. The factories realize that new car business will be large only as long as used cars are kept moving at a proportionate rate.

Edsel Ford Optimistic Over Business Outlook

NEW YORK, April 20—Edsel B. Ford, president of the Ford Motor Co., in a statement here yesterday took an exceedingly optimistic view of the industrial outlook. He declared his company

expects its production for the year to reach a high water mark of 1,150,000, compared with 1,038,000 cars and trucks last year. He added that the new plant at Green Island near Troy, in which all ball bearings and roller bearings will be manufactured, will be in operation late in the year. Ford stated that no further reduction in the price of Ford cars is contemplated at this time, notwithstanding prospective competition.

INDUSTRIAL NOTES

K. O. Muehlberg Co. of Manitowoc, Wis., manufacturer of a new type of automatic drill and other mechanical devices for automotive, gas engine and service shops, has acquired the Hoffman Glove Co.'s factory in that city. The Hoffman company is moving to Chicago, and will give possession about May 1. Karl O. Muehlberg began manufacturing tools several years ago and incorporated about three months ago. The industry has grown so rapidly that a number of buildings in addition to the original shop have been leased for short terms to keep production apace with demand.

Dickinson Cord Tire Corp., New York, announces the following officers: President, F. S. Dickinson; secretary, E. W. McCarty, active head of the J. C. McCarty Co., New York; treasurer, C. H. O'Connor, New York, identified with real estate and insurance interests; directors, Louis C. Block, Philadelphia, former Ford branch manager and now distributor for the Gray Motor Corp. and N. R. Bagley, president of the N. R. Bagley Co., New York.

International Harvester Co. will open bids this month for the construction of two units of the motor truck plant it will build at Fort Wayne, Ind., and expects to begin actual work May 1. Each of the buildings will be 200 x 600 feet and will cost \$1,000,000. Much preliminary work has already been done at the site of the plant where the company owns several hundred acres of land.

Curtis Motor Car Co., Little Rock, Ark., has been placed in the hands of H. V. Forl as receiver upon petition of one of the stockholders, Dr. Benjamin A. Adams. The company was organized in 1919 but was not incorporated. About 25 or 30 cars were completed at the plant in Little Rock.

Studebaker Corp. has plans underway for a new power house at its plant in South Bend to cost about \$750,000 and a storage and shipping building provided with crate handling and conveying machinery estimated to cost approximately \$500,000.

Hinckley-Myers Co., Jackson, Mich., has opened its eastern sales and executive office in the General Motors Building, Detroit. William A. Kent is the eastern sales manager and John E. Moore, general sales manager.

Simms Magneto Co. will open a branch office and show room at 5781 Woodward Avenue, Detroit, May 1, with L. F. Acker in charge. The branch will cover the states of Ohio and Michigan.

BRITISH EXPORTS DECLINE

WASHINGTON, April 18—Automobile exports in Great Britain for February show a big decline over the previous month, there being £100,001 worth exported in February against £147,254 in January, according to reports received by the Automotive Division of the U. S. Department of Commerce.

METAL MARKETS

Actual steel consumption, always more or less of a mystery, is the unknown quantity in the present steel market. Mill output at this time has grown probably to a rate of 37,000,000 or 38,000,000 tons a month, as compared with just about one half that tonnage last December, and statistically this is looked upon as the apparent consumption. In the present condition of the steel industry and its principal consuming arteries it is, however, obvious that there must be a wide discrepancy between apparent consumption or mill production and actual consumption or the amount of steel that goes into finished products and therefore disappears definitely from reserve holdings. In the absence of figures covering actual consumption which are unobtainable, sentiment counts, and many shrewd market observers are of the opinion that a much larger tonnage of the steel now being produced is intended for reserve than was the case during the year's first quarter.

All of the tonnage that mills are now working on was sold at the prices that prevailed previous to April 1, and a large number of consumers have not only covered their wants for the second quarter at these prices but, unless their own consumption should undergo unexpected increase, they will have some reserve stocks to draw upon after the first half of the year has passed into history. Automotive plants that have covered their sheet wants until June care very little whether the market at the higher prices proclaimed April 1 is characterized as firm or not. They will not begin to worry on that score until much of the steel now due them from mills at old prices has been worked up.

There have been quite a few odd lot sales of sheet bars at \$31, Pittsburgh or Youngstown, and in at least one transaction an even higher price has been mentioned. In spite of many misleading headlines in the daily newspapers there is no shortage of coal at the steel mills but as the result of the Connellsville region walkout of non-union miners there is a temporary curtailment in the coke output of bee-hive ovens that supply fuel for about one-fifth of the country's blast furnaces. Conservation of semi-finished steel for producers' own finishing mills comes as a natural precaution but there is no more justification for a panicky feeling regarding steel mills' fuel supply than there was at the outbreak of the strike.

Pig Iron.—The coal strike is being used as chief argument in support of advance of 50¢ @ \$1 per ton on all grades and in all markets.

Aluminum.—The market for 98 to 99 per cent pure virgin ingots has hardened and lots below 18¢ have generally disappeared. With the Senate Finance Committee concurring in the aluminum schedule of the Ways and Means Committee of the House, importers, while still hoping against hope for a more moderate rate of duties as the result of arguments on the floor of the Senate or in the conference committee, are laying out their program resigned to the seemingly inevitable. The very large warehouse stocks of ingots make it dubious whether large holdings at the time when the tariff law goes into effect would prove profitable within a reasonable time. The situation with reference to sheets is somewhat different. Undoubtedly these will be considered a good investment with the expected rise in tariff rates.

Copper.—Although domestic sales are not large the market's tone is slightly better.

Calendar

FOREIGN SHOWS

March 10-July 31—Tokio, Japan, Peace Exhibition.
April 16-23—Mexico City, Annual Automobile Show, Auspices of the Automotive Division of the American Chamber of Commerce.
April 22-May 1—Prague, Czechoslovakia, Fourteenth International Automobile Exhibition.
May—Shanghai, Exhibition of Road Building Material.
May, 1922—Quito, Ecuador, Agricultural Exposition celebrating Centenary of Ecuador, Automotive Section.
May 1-15—The Hague, Automobile Show, also Airplanes and Motorboats, Secretary, Spui 185, The Hague.
May 6-21—Scheveningen, Automobile Show.
May 24-June 5—Barcelona, Spain, Automobile Show under Dealers' Direction.
May, 28-June 5—Prague, Motor Show, Hotel de Ville.

July 1-24—London (Olympia), Aircraft Exhibition.
Sept. 1922—Rio de Janeiro, Brazil, Automobile exhibition in connection with the Brazilian Centenary Association, Automobilsta Brasileira.
Sept. 15-20—The Hague, Automobile Show.
September—Buenos Aires, Argentina, Annual Exhibition, Sociedad Rural Argentina.
October—Paris, Automobile Show.
Oct. 12-23—London (Olympia), International Commercial Vehicle Exhibition.
Nov. 3-11—London (Olympia), Automobile Show.
Nov. 10-Dec. 19—Brussels, Automobile Show, Palais de la Cinquantenaire.
Nov. 29-Dec. 4—London (Olympia), Cycle and Motorcycle Show, British Cycle Motors, The Tower, Warwick Road, Coventry.
November—Buenos Aires, Argentina, Annual Exhibition, Automovil Club Argentino.

CONVENTIONS

April 20-22—Buffalo, N. Y., Sixth Annual Convention of the American Gear Manufacturers Association.
May 8-10—New York, National Association of Manufacturers.
May 10-12—Philadelphia, Ninth National Foreign Trade Convention of the National Foreign Trade Council.
May 12—New York, Annual Meeting, National Highway Traffic Association, at the Automobile Club of America.
May 16-18—Washington, D. C., Annual Meeting of the Chamber of Commerce of the United States.
May 22-25—New York, Palisades Interstate Park, Second National Conference on State Parks, Bear Mountain Inn.
June 11-15—Milwaukee, Annual International Convention of the Associated Advertising Clubs of the World.

June 19-24—Colorado Springs, Summer Meeting, Automotive Equipment Association.
June 26-July 1—Atlantic City, Twenty-fifth Annual Meeting of the American Society for Testing Materials, Chalfonte-Haddon Hall Hotel.
August 28-Sept. 2—Detroit, National Safety Congress.
Sept. 18-22, 1922—Rome, Italy, Second Annual Meeting of the International Chamber of Commerce.

S. A. E. MEETINGS

June 20-24—White Sulphur Springs, W. Va., 1922 Summer meeting of Society of Automotive Engineers.
New Haven, April 21; Cleveland, April, 21; Detroit, April 21; Philadelphia, April 27; Indianapolis, May 8; Chicago, May 12; Detroit, May 19. The Pennsylvania section will hold an outing at Torresdale or a body meeting on May 25.

February Big Month in Canadian Exports

Shipments of Cars Gain 100 Per Cent Over January—Trucks, 39 Per Cent

WASHINGTON, April 18—Canadian automobile exports in February compared with January of this year show an increase of approximately 100 per cent in the number of passenger cars and 39 per cent increase in the number of trucks exported, according to reports received by the automotive division of the United States Department of Commerce.

The February exports of passenger cars were 2719, valued at \$1,539,936, but only two came into the United States, these being valued at \$2,335. January exports were 1344 passenger cars, valued at \$904,667, of which 5 were imported into the United States, these having a value of \$7,240.

More Trucks Exported

There were 264 trucks valued at \$119,619 exported in February, compared to the exportation of 98 trucks valued at \$43,962 in January. Of the February trucks exported, but one came into the United States, valued at \$2,500, while none were imported into the United States in January.

Repair parts exported in February were slightly less than the January exports, there being \$188,923 January repair exports against \$105,913 February shipments.

Of the 2719 passenger cars exported from Canada in February, the last month for which figures are available, 1267 went to Australia; 547 to the United Kingdom; 204 to Argentina; 162 to South Africa; 107 to the Dutch East Indies and the remainder to more than 50 other countries.

Practically all of the trucks exported went to Australia during February, as did more than 50 per cent of the repair business. British India ranked second with 21 trucks received; Ceylon third with 17, and United Kingdom fourth with 16 trucks imported from Canada.

The declared exports from the United States during February were 3096 passenger cars and 454 motor trucks. Adding these to the Canadian shipments, a total of 5815 cars and 718 motor trucks are shown. No month since December, 1920, has shown a higher volume of passenger car exports.

Belgian Law Regulates Equipment on Trucks

WASHINGTON, April 14—In an effort to save the newly constructed highways of Belgium, legislation has just been passed compelling all motor trucks and trailers, weighing one ton per axle and over, to be equipped with rubber tires, according to foreign information of the U. S. Department of Commerce.

The same bill provides that all mufflers must exhaust downward against the ground. The existing laws require that all mud guards must be constructed so as to prevent all scattering. How this is to be done, however, is not stipulated in the bill, although the regulation requirements of the city of Brussels require a wide flange on the guard, which more or less prevents excessive spattering of mud.

S. M. KITCHIN DIES

RICHMOND, IND., April 18—Announcement is made of the death of S. M. Kitchin, for years connected with the Auburn Ignition Manufacturing Co., Inc., and other manufacturing and selling companies in the automobile and hardware fields. Kitchin served as sales manager, general manager, vice-president and director of the Auburn company.

State to Build Road for Motor Truck Use

30-Mile Stretch Will Parallel Boston Post Road in Connecticut

HARTFORD, CONN., April 18—State Highway Commissioner Charles J. Bennett has announced that the thirty-mile concrete state highway, which will be built exclusively for motor trucks, will extend from Bridgeport to the state line at Greenwich and will parallel the Boston Post Road. This is said to be the first time in the history of American road building that such a road has been seriously considered by reason of the expense involved.

Surveys are now being made by the highway department and the project is being closely observed by the Federal government. The highway commissioner is personally supervising the making of the surveys. In addition, the highway commissioner is to have the Boston Post Road surveyed from the air, the object being to secure a panoramic view. These views, which will be joined together, are to be taken at the busiest time of the day. It is said that traffic is heavier on the Boston Post Road than on any other road in the country.

Cost Estimated at \$1,500,000

Bennett estimates the cost of the thirty-mile truck road at \$1,500,000. It was deemed advisable to construct a road exclusively for trucks rather than widen the present highways to accommodate the heavy commercial vehicle travel. Statistics show that an average of 10,000 vehicles a day travel over the road, and of this number trucks are represented to the extent of 2000, most of them long distance freight haulers.

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No. 17

Survey Proves Highway Transport Economic Necessity

Report of Joint Commission of Agricultural Inquiry shows broad vision of future needs. Will recommend promotion of highway construction and maintenance. Urges a correlation of highway transportation with rail and water transportation.

AFTER the most comprehensive survey of the distribution and marketing problem ever undertaken in the United States the Joint Commission on Agricultural Inquiry, headed by Representative Sydney Anderson of Minnesota, has completed its report to Congress. One section of the report is devoted to highway transport. The importance of this arm of highway transportation service is given official Congressional recognition for the first time.

While the purpose of the commission, as outlined in its warrant from Congress, was primarily to make a thorough study of the problem of distribution and marketing, its recommendations to Congress, based upon a careful analysis of the enormous mass of data assembled, undoubtedly will carry great weight in framing legislation.

It is significant that the commission, after announcing that "nothing since the advent of railroads has had so marked an economic and sociological effect upon the life of the country as the motor vehicle," will recommend "that Congress promote highway construction and maintenance direct to the more effective correlation of highway transportation with rail and water transportation."

In its survey of the problem before it, which never has been adequately studied in this country, the com-

mission worked back from the ultimate consumer as represented by the retailer, through the wholesaler and the manufacturer to the producer. It obtained specific data on every element of cost from the time agricultural products left the farm until they reached the last station in the point of distribution.

In gathering this information the commission sent out 30,000 questionnaires in which 25,000,000 questions were asked. In analyzing the data more than 50,000,000 calculations were made. This mass of material now has been digested and put together in a formal report.

One striking fact revealed in a digest prepared by Chairman Anderson of that part of the report referring to motor transport is that while motor vehicle traffic increased more than 1900 per cent in the period from 1910 to 1921, the actual expenditure for highway construction and maintenance, taking into consideration the increase in cost of materials and labor, was only slightly over 200 per cent. In his digest Anderson says:

Nothing since the advent of the railroads has had so marked an economic and sociological effect upon the production life of the country as the motor vehicle. The Commission will recommend that Congress continue to promote an adequate program of

highway construction and maintenance, directed to the more effective correlation of highway transportation with rail and water transportation.

Also that the program of highway construction and maintenance by States and counties be continued under the direction of qualified experts, with particular reference to the construction and maintenance of farm-to-market roads; that adequate funds should be appropriated for research and regulation of traffic based upon the facts so ascertained.

Also that the several States co-operate in effecting a uniform basis for taxing motor trucks and other motor vehicles, which shall fairly represent the proportion of expense of highway construction and maintenance chargeable to such vehicles.

Previous to its appearance, the economic zone of transportation was sharply defined by the haulage range of the horse and the cost of such transportation. It will be shown in the report that in 1918 the estimated cost of hauling in wagons from farms to shipping point averaged about 30 cents per ton-mile for wheat, 33 cents for corn and 48 cents for cotton. Hauling in motor truck or by tractors the averages are 15 cents for wheat and corn and 18 cents for cotton. In the same year wagon hauling averaged 9 miles from farm to shipping point and motor truck hauls 11.3 miles; the motor truck averaged 3.4 round trips per day over its longer route, while wagons made 1.2 round trips per day.

It thus appears that the major result accomplished by this new form of transportation has been to extend and broaden the markets of the farmer. Single reactions are to be found in the fact that the use of the motor vehicle has brought the farmer closer to the city and also has increased the desirability and comfort of farm life.

Figures in the report will show that while the motor vehicle traffic has increased more than 1900 per cent in the period 1910 to 1921, the actual expenditures for highway construction and maintenance, taking into consideration the increase in cost of materials and labor during the war and the readjustment period, was only slightly over 200 per cent.

In some sections the combination of inbound farm products and outbound supplies by motor truck has concentrated upon the motor truck service the majority of the traffic within 30, 40 and 50 miles, and the Commission believes that the effect upon rail carriers has been to reduce the amount of local way freight and that ultimately it will reduce the number of local freight trains operated.

"Since the growth in the use of the motor vehicle has been very markedly in advance of highway construction and maintenance," Chairman Anderson said, "and since it has brought with it a new and heavier form of highway traffic, it becomes evident that large funds will have to be expended if the 2,500,000 miles of rural highways in the United States are brought up to the standard of efficiency comparable to the extended use of the roadbeds."

Another effect of improved highways is to enable the farmer to hold his products on the farm for a longer time. Where highways are unimproved the farmer must move his produce when the roads are good, which is gener-

ally at the season when the prices are lowest. Improved highways thus make not only for a broader market but for a more stabilized one.

The Commission believes there should be regulation of the use of the highways, especially with respect to overloading and maximum loading to be based upon the facts so developed. It will also urge that since poor highways not only increase the cost of transportation of commodities from farm to market, but also affect the comfort of the farmer and prevent him and his family from a full enjoyment of communication with his neighbor, all highways wherever possible should be improved and adequately maintained.

It is already clear that there is a wide variation in principle and application of the various State and local regulations affecting intrastate motor traffic. Studies of local motor transportation should be expanded as rapidly as possible to afford a definite and comprehensive basis for uniform regulation of motor transportation in order that the inconvenience, expense and inefficiency of operation occasioned by a lack of uniformity in State and Federal legislation in the future may as far as possible be avoided.

Electric street railways, the Joint Commission has found, have suffered to some extent from the encroachment of the automobile upon their revenues. This competition, which is the first competitive activity to be felt by the street railway, has not seriously affected the revenues except in individual cases, and will not be fatal to their successful operation where these competing forms of transportation

are subject to regulation and control by the proper regulatory bodies. When they are required to assume the same responsibilities as to service rendered and license fees and taxes paid they have not proved to be detrimental to existing transportation agencies.

Viewed in a general way the recommendations reviewed above are of considerable importance to the automotive industry. Sponsored by the powerful farm interests, the recommendations of the Joint Commission of Agricultural Inquiry will shortly be presented to Congress and are likely to be embodied in future legislation.

Thus the industry will note with favor the high tribute paid to the motor vehicle as an essential part of the economic life of American agriculture.

It has long been obvious to students of the question that the motor vehicle is fulfilling a utility function in the conduct of industry and agriculture and that it is an important unit in economic progress. This contention has been justly and strongly made by the automotive industry for some time past.

It is highly useful, however, from a practical standpoint, to have this view of the essential utility value of the motor vehicle so strongly stressed in an impartial and powerful document of this kind.

The report as a whole covers the many economic phases affecting agricultural progress. Digests of the various sections are being published currently. The entire report will probably be ready for publication some time in the near future and can be read with profit by all interested in the subject.

HERE are some of the chief points brought out in the report: "Nothing since the advent of the railroads has had so marked an economic and sociological effect upon the production life of the country as the motor vehicle."

"The major result of this new form of transportation has been to extend and broaden the markets of the farmer."

"Large funds will have to be expended to bring the 2,500,000 miles of rural highways up to a standard of efficiency comparable to the extended use of roadbeds."

Minor Changes in New Packard Single Six

Wheelbase has been lengthened and half inch has been added to stroke of engine. Slight change in carbureter design. Instrument board has been redesigned, and windshield mounting improved. Deeper side rails employed.

NO radical engineering changes have been made in the new Packard single six chassis, which was briefly announced in AUTOMOTIVE INDUSTRIES last week. A complete line of bodies is being supplied mounted on two wheelbase lengths of respectively 126 and 133 in. The only alterations of a design character are those intended to take care of the longer wheelbase and the larger body sizes. A half inch has been added to the stroke of the engine, making the bore and stroke now $3\frac{3}{8}$ by 5 in. The lengthening of the stroke has been accompanied by the use of a lighter, more rigid and more servicable connecting rod. The valve spring retainer shape has been altered, the water pump relocated to add to cooling efficiency under certain operating conditions, the ignition system simplified and some detailed changes have been made in the design of the carbureter. These changes have resulted in a 10 per cent increase in engine output.

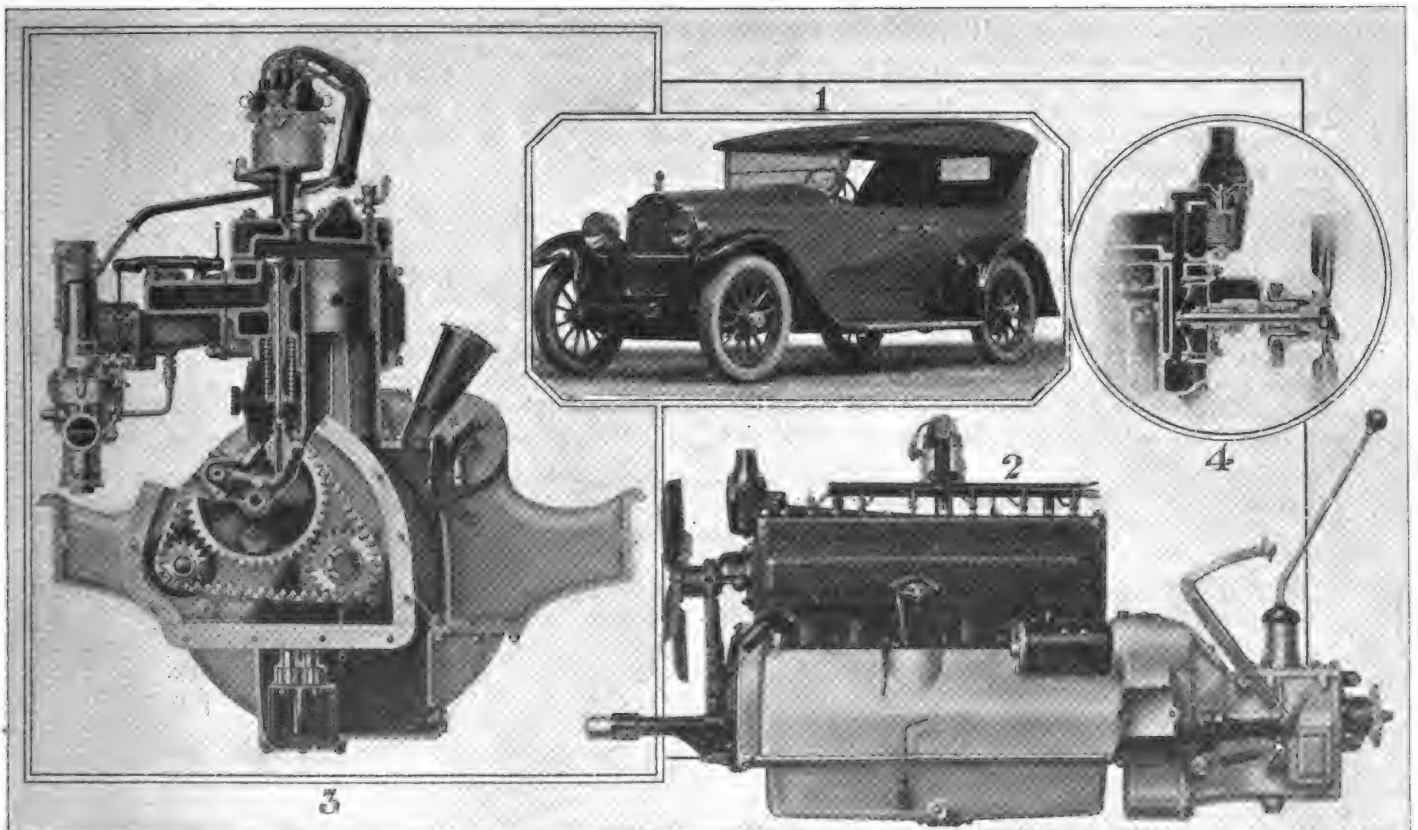
A slight change has been made in the clutch to provide for four driving plates instead of three. The gear ratios are now 4.3 to 1 in the 126-in. wheelbase chassis

and 4.66 to 1 in the 133 in. Both sets of gears are carried in service stock and are interchangeable so that it is possible to use the low gear ratio in the 126-in. wheelbase and the high ratio in the 133 in., if desired.

The relocation of the water pump has made it easy to take off the cylinder head without loosening the radiator, fan, etc., and resulted in a shortening of the fan belt. The engine is now equipped with a new type of fan which gives better efficiency. The outside water pipes have been eliminated and there are only two water hose connections. All of the piping for the deflection of water when the thermostat is closed is cast into the cylinder head and the water outlet manifold is provided for in the bolted-on cover plate.

Other detail engine changes increase accessibility. The fact that the ignition distributor is now mounted directly on the top permits the cylinder head to come off more readily and the fan and front end chains are readily adjusted from the exterior. The generator mounting is also more accessible.

A chassis change of importance is the greater rigidity



1—Complete car showing improved body lines and lengthened wheelbase. 2—Engine, clutch and gearset unit. 3—Sectional end view of engine. Ignition distributor mounted on top. 4—Cross-section of fan, water pump and thermostat

of the frame side rails. These have been increased in depth to $7\frac{1}{2}$ in. for the 126-in. wheelbase and 8 in. for the 133-in. There is a new front cross member designed to provide for greater rigidity in the front end of the frame and to furnish a more substantial support for the radiator while improving the front end appearance.

There are a great many detail changes for both appearance and quietness, as well as accessibility. A simplified system of conduits and junction boxes has improved the electrical installation and, concealing the cables on the inner dash surface, adds to both appearance and protection. An enameled sheet steel container makes the storage battery more accessible and secure. An improvement has been made in the exhaust system. The vibration set up by the pulsating gases in the exhaust system has been eliminated by the more rigid system of bracketing in a specially designed outlet fitting. The gasoline tank has been redesigned to locate the filler cap on the left side. When the tank is full this location prevents leakage of fuel due to the crown of the road.

A number of detail changes are apparent on the exterior of the car and are designed to improve appearance or to provide greater convenience for driver and passengers. The new type radiator has a nickel plate shell with a convex front surface which relieves the severity of the sharp corners. The radiator is mounted differently. Heretofore, it has been set on built-up pedestals which are now done away with and the front end cross member is so shaped that the radiator frame rests directly on it. This adds to the stiffness of the front end of the frame and the same time providing a more rugged mounting for the radiator.

A new feature has been added in the hood rest, both on the radiator and at the cowl. The fabric is placed some distance under the hood so that a little space is provided both at the radiator shell and the cowl. This eliminates the possibility of the hood coming in contact with metal either edgewise or flatly and thereby prevents the possibility of hood noises.

The dash is now a steel stamping, fitted with a backing of wood to deaden the sound. An improvement in the cowl ventilator is designed to make water leakage impossible. The edge is crimped up so that water, when blown up on the cowl, will not enter, but be carried around to the back and run off. The ventilator is also provided with a lever adjustment on a tight spring, with three different locations for adjustment. On the side hood panels, the louvers are cut in instead of pressed out.

A completely redesigned instrument board is now provided. This has two oval glasses, one of which is a combination speedometer and clock of Waltham manufacture and under the other is the oil pressure gage and

ammeter. The switch is just to the left of these two ovals and the dash light is operated with a separate button on the top of the switch. An improvement has been made in the windshield mounting. Rubber pads have always been provided to prevent leakage around the windshield base, but on the new cars these are improved by the use of a rubber pad that runs completely under the lower half of the windshield and is entirely made in one piece. The lower portion of the windshield does not move and is also equipped with rubber fillers. The doors on all models are now made flush so that there will be no overlapping moldings to break the body line. The inside door handles on the new cars are so designed as to unlock the door by either an up or down motion. The rear end of the muffler pipe is now equipped with a nozzle which is flattened out in such a way that the exhaust will not strike the ground, sidewalk nor the spare tire. This nozzle is connected by a rod to the spare tire rack to make it solid. The irons for supporting the top when down are not visible when the top is up. They fit into sockets in the body which are hidden by the gypsy curtains when the top is up.

A complete line of open and closed bodies is provided on these two chassis. On the 126-in. chassis are mounted the five-passenger touring, two-passenger roadster, four-passenger coupe, five-passenger sedan and four-passenger sport. On the 133-in. chassis are the seven-passenger touring, seven-passenger sedan and seven-passenger sedan-limousine.

On the inside of all of the doors on the closed car models is a cloth loop which is set in the doors to use for closing it from the inside. The window regulators on the doors of the sedans and on the coupes are moved forward to be out of the way. In all sedan models the robe rail is made of tubular braided cloth. All except the right front doors are equipped with inside locks, so that it is only necessary to lock the right front door from the outside. In the 133 sedan-limousine, outside locks are provided on both right-hand doors. All closed cars are equipped with visors of metal which are covered and rolled around a rod at the front end. The windshields are vertical on the closed jobs in order that the water will not blow up and through the windshield and the double pillars at the front corners have been eliminated.

The fundamental specifications of the Packard chassis have not been altered. The engine is a six-cylinder, block cast, three-point suspension unit of $3\frac{1}{2}$ -in. bore and 5-in. stroke. The horsepower on the block is claimed by the manufacturers to be over 54. The clutch is a multiple disk, dry plate type with four driving plates. The tire equipment is 33 by $4\frac{1}{2}$ -in. rib tread front and non-skid rear, cords. Wood wheels are standard on all models except the sport, which use disk steel wheels. On all other models the disk wheels are optional at \$35.

Welded Valve Seats Tested

IN view of the interest among automobile manufacturers concerning the use of alloy steel valves with welded seat of heat-resisting alloy, some recent tests by the Power Plant Section of the Engineering Division, Air Service, McCook Field, are worthy of study. The tests were made particularly to study the properties of a welded valve seat, the seat being a cobalt-chrome alloy. The valve is a product of the Rich Tool Co.

It was found that the bond between the body of the valve and the material is satisfactory and should withstand severe service conditions. It was also found that the welded-on seat material, which is an alloy mainly of

cobalt and chromium, is resistant in a large measure to attack by 20 per cent aqueous sulphuric acid. When the valve was subjected to a highly oxidized flame at a temperature of about 1350 deg. Fahr. the chrome-tungsten steel of the valve proper scaled perceptibly, but the welded-on seat showed only slight oxidation. It was found that the alloy possessed non-staining and non-oxidizing properties in high degree.

More extended service tests are to be given this type of valve and the expectations are that it will prove out satisfactorily. Metallographic studies showed a very satisfactory structure at the weld.

Gear Makers' Convention of Much Technical Interest

Papers presented on good hob practice, use of the projection comparator in testing gear teeth, proportion of industrial gears, the grinding of gear teeth and a new system of bevel gears. Definite progress made in standardization work by the American Gear Manufacturers Association.

By P. M. Heldt

THE Sixth Annual Convention of the American Gear Manufacturers' Association, held at the Lafayette Hotel, Buffalo, April 20-22, was well attended and disposed of a well-rounded program. President Sinram in his opening address said that perhaps never before in the memory of anyone present had business been so sorely tried as during the past year. During the depression, which now fortunately seemed to be passing, old and seemingly well established firms had tottered and fallen, and fortunes had been lost. In many fields of industry a housecleaning was absolutely necessary. The gear industry presented a firm front, although it might show a dent here and there. He did not like to strike a pessimistic note, as he was naturally an optimist, but it was necessary to look facts in the face. He expected a gradual and steady improvement during the current year. No lasting prosperity could be looked for until the volume of our exports had assumed reasonable proportions. A definite start had been made on the upgrade in business, but the demands of the new era would be exacting. There had never been a time when those in the same field of industry could counsel together with as much profit as at present. Hereafter the Association should look particularly after the commercial problems confronting the gear industry. By stabilizing their industry they would help to stabilize business in general.

Mr. Sinram made reference to two group meetings to be held during the convention to consider business conditions in the industrial and automotive fields respectively. He thanked the chairman and members of the executive committee and all other committees for their efforts during the past year which, he said, had been a most trying period, and also thanked the membership for the confidence reposed in him during his five years as president of the Association.

Tariff, Public Relations and Public Policy

During the session on Thursday morning reports of numerous committees were received and several new members elected. S. L. Nicholson presented the report of the Tariff Committee, in which he gave an outline of the present situation with regard to tariff legislation. J. B. Foote reported for the Industrial Relations Committee and advocated the adoption by the membership of an apprenticeship system in order to train competent help. He said that during the war and the two years following many men had been taken on without any previous training, but most of these had now returned to the farms or to other forms of common labor, and already a dearth of skilled help was felt in several of the most important industrial districts. Mr. Foote said

that they all knew of the difficulty in getting a good all-around machinist and that this was largely due to the fact that there was no regular apprenticeship system in this country. Mr. Sawtelle, who had attended the meeting of the National Metal Trades Association in New York during the early part of the week, said that much consideration had been given by that Association to the apprenticeship problem and that six different systems had been worked out and were now being investigated. It was therefore decided to co-operate with the National Metal Trades Association in this matter.

Henry E. Eberhardt reported for the Public Policy Committee. He said that some concerns still adhered to the policy of providing their machines with screws and gears of non-standard pitch, their reason being that by so doing they expected to establish a monopoly on the supply of repair parts. Mr. Eberhardt said that this policy was opposed to the interest of the user, and he suggested that all members educate their customers to calling for standard gears when ordering machines of any kind.

From the report of the secretary it developed that the Association now has 94 member companies, with 109 executive members and 53 associate members. The Automotive Gear Works at Atlanta, Ga., and the Willys-Morrow Co. of Elmira, N. Y., are new member companies admitted at the convention, and additional associate members from the Westinghouse and General Electric companies were also elected.

Good Hob Practice

During the morning session on Thursday H. E. Harris, of the H. E. Harris Engineering Co., read a paper on good hob practice. Mr. Harris' paper was based upon experiments made with lathe and similar cutting tools about ten years ago in which it was found that better results are obtained as regards the rate at which stock is removed, the accuracy of the work and the durability of the cutting edge if the tool is given a "hook" and a "rake." These principles were later applied to milling tools and to hobs for cutting gears and splines and were found to work out equally well in these lines. Heretofore the teeth of hobs have been generally made with the forward side radial, but it is found that if this face is given a slight angle with relation to the radial plane to the cutting edge, the cutting qualities are improved. Exactly what this angle should be for best results has not yet been determined. In the discussion of this paper it was brought out that in making hobs allowance must be made in the outline of the cutter for the "hook" and the "rake," as otherwise the tooth shape will not be

correct. Mr. Buckingham pointed out in this connection that it is very difficult to determine the modification required. Mr. Flanders said that the amount of the "hook" should be stamped on the hob, as otherwise the operator, when grinding the hob, had nothing to guide him and the angle would increase or decrease after repeated grindings. Mr. Harris said that the same thing applied to hobs with radial teeth.

Standardization Work

At the afternoon session Ralph E. Flanders, of the Jones & Lamson Machine Co., presented a paper on "The Use of the Projection Comparator in Testing Gear Teeth," which was accompanied by a demonstration of the device. We expect to print Mr. Flanders' paper in an early issue of AUTOMOTIVE INDUSTRIES. Following this, B. F. Waterman, chairman of the General Standardization Committee, first presented the report of the Sectional Committee on Gears of the American Engineering Standards Committee. He said that a meeting of the Sectional Committee was held October 27 last and that consideration was given to the present S. A. E. standard for starting motor pinions which reads as follows: "Flywheel starting motors shall be equipped with an 8-10 pitch, 11 tooth, 20 deg. pressure angle pinion. The clearance on the pitch line between the pinion and the flywheel shall be from 0.015 to 0.025 in." It is suggested by the Sectional Committee that "clearance on pitch line" be made backlash. It was further agreed to define backlash as follows: "Backlash is the play between the teeth of a pair of gears mounted at the specified center distance, the increased width of space to be obtained by an addition of not more than 0.025 in. in the thickness of the cutter, so that the bottom diameter will not be so small as to weaken the pinion." The secretary was instructed to write to the S. A. E. for approval of this suggested modification. The Sectional Committee in going over the A. G. M. A. standards and proposed standards made a number of other suggestions. For instance, in connection with the A. G. M. A. composition gear standard, which mentions by name several materials now used for non-metallic gears, it was suggested to delete these names, as trade names are not to be used in American standards.

Various changes were also suggested in the A. G. M. A. recommended practice for gear inspection, which has been published in a previous issue of AUTOMOTIVE INDUSTRIES. These changes are as follows:

Gear Inspection Changes

"Keyways.—Keyways, single and multiple, for straight and tapered holes, should be inspected for width by using 'go and no go' flat limit gages, gaging the width only. For alignment a plug gage with a key or keys will be used, with the diameter of the plug and width of key enough smaller than the low limits to meet the requirements of the work in hand. The key should be long enough to reach the entire length of the keyway; the height of the keyway equal to the customer's low limit. If the maximum depth is important, a similar gage should be used as a 'no-go,' having a height equal to the maximum shown in the customer's drawing. Keyways for Woodruff keys should be inspected by using a hardened gage similar in shape to the key, slightly thinner than standard, and sliding a key-seated ring gage over the key when in place in the keyway. Two keys may be put in the ring gage to agree with the depth limits on the customer's drawing. For width of keyway in the shaft, use a 'go and no-go' flat limit gage, both ends of which should agree with customer's limits.

"Shafts.—Splined shafts should be checked for width

of spline, roots and outside diameters, using 'go and no-go' snap gages made to the dimensions given on the customer's drawing or a micrometer used. For accuracy of spacing use a ring gage having one portion ground to the minimum limit of the large diameter, bottom to bottom of keyways, in the mating part, and at one end a slotted portion with a diameter of hole equal to the minimum diameter of the bore of the mating part and made with slots of width equal to the maximum limit of the spline of the shaft.

"Shifter Grooves.—Shifter grooves should be inspected for diameter at the bottom of the groove by using a 'go and no-go' snap gage slightly thinner than the width of groove and made to dimensions of customer's drawings or a micrometer used. If a fillet is called for around the edge, round the snap gage enough to clear. For width of groove use a 'go and no-go' flat limit gage made to limits upon customer's drawings.

"Small Size Spur, Helical and Internal Gears.—Smaller size spur, helical and internal gears should be checked for pitch diameter, eccentricity and irregular teeth by inspecting on a hand stand, the essentials of which should be rigidity of construction, one rigid and one freely sliding head, so arranged that the movement of the sliding head will actuate a dial indicator. Hardened master gears of proven accuracy should be used. The studs on which the work and master are mounted should be at right angles with the surface on which the sliding head moves and parallel with each other within 0.002 in. in 12 in. The diameter of the work stud should equal the diameter of the 'go' gage, and the stud in the master gear should be about 0.00025 in. less than the hole."

This recommendation also included the definition of backlash which has already been given. The above recommendations of the Sectional Committee were adopted by the A. G. M. A.

At a further meeting of the Sectional Committee, held on January 19 last, a research committee on gears was appointed, consisting of Wilfred Lewis, Earle Buckingham, A. M. Greene, Jr., R. E. Flanders and Charles E. Logue. At this meeting it was voted that the S. A. E. starting motor pinion standard with the proposed changes be submitted to the sponsor bodies as a proposed tentative American standard, provided the proposed changes met with the approval of the S. A. E.

Mr. Waterman also made a brief report for the General Standardization Committee of the A. G. M. A. He said that practically all of the work of this committee had been carried on jointly with the Sectional Committee.

Bevel Gear Committee Report

Several subcommittees of the Standards Committee also reported during this session. The most important of these reports from the automotive standpoint was that by F. E. McMullen, chairman of the Bevel and Spiral Bevel Gear Committee, which follows:

Backlash.—The amount of backlash varies with the pitch of the gears and the committee suggests the following amounts for bevel gears:

D. P.	Backlash*	D. P.	Backlash*
12 .....	.003"-.005"	4 .....	.008"-.012"
10 .....	.003"-.005"	3 .....	.010"-.014"
8 .....	.005"-.008"	2 .....	.015"-.020"
6 .....	.006"-.009"	1½ .....	.021"-.027"
5 .....	.007"-.010"	1 .....	.031"-.040"

*Backlash specified above is to be measured when the pitch lines of the gears are together. Runout of the pitch line will affect the backlash, which should be measured at the tightest point. In the case of gears to be hardened the backlash measurements should be made before hardening.

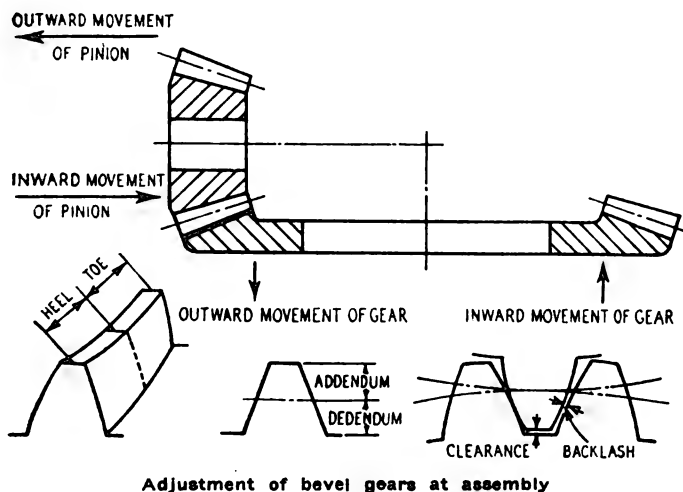
For bevel gears above 2 D. P. the backlash can be obtained from the following rule:

$$\text{Backlash} = 0.01 \text{ in.} \times \text{circ. pitch} \times \frac{0.0314}{\text{D. P.}}$$

Adjustment of Gears at Assembly

The proper adjustment of bevel gears at assembly is a vital factor in obtaining quiet and durable gears.

There are two distinct considerations in obtaining the proper tooth contact; one is the bearing along the tooth, lengthwise bearing, the other the bearing up and down the tooth or profile bearing, and it is essential that the two be considered separately to obtain the proper results in combination.



Adjustment of bevel gears at assembly

In the above illustration are given graphic definitions of the terms used in describing the proper procedure to mount a spiral bevel gear. Gears are cut with a predetermined amount of backlash to suit the pitch and operating conditions, and this backlash should not be altered by any great amount to obtain the proper tooth contact, as the necessity of such a step indicates a fault either in the cutting or in the alignment of the supporting bearings. The usual amount of backlash is from 0.004 in. on 8 pitch gears to 0.012 in. on 3 pitch.

Gears, when mounted in a rigid testing machine, should show a bearing toward the small end of the tooth, and the amount the bearing favors the small end is determined experimentally by the stiffness of the mounting the gears are to be finally assembled in. Any spring in the mounting of the gears under load will cause the bearing to move toward the large end, and in no case should the bearing be heaviest at the large end of the tooth under the operating load. Any extra load, such as induced by suddenly applying the full load, will cause the bearing to become concentrated on the top corner of the large end of the tooth and breakage will ensue. In the figures below are shown typical tooth bearings obtained in a testing machine and when mounted in an automobile axle, also the effect of spring in the mounting on the apexes of the gear and pinion. It will be observed that the apexes do not coincide when the gear mounting has sprung under the working load. Therefore, when cutting the gears, it is necessary to make provision for this lift or spring.

Bevel gears are commonly cut to run flush at the large end of the teeth, and as a first step they should be so assembled in the mounting for an initial trial. Powdered red lead and any light machine oil should be

mixed and spread over the working surfaces of the teeth with a brush to show clearly the tooth contact that is obtained.

There is no difference in the method of adjusting spiral or straight bevels, and while the following statements are particularly applicable for spiral bevels, they are also true for straight bevels.

After mounting the gears flush with the proper amount of backlash, they should be operated under load in each



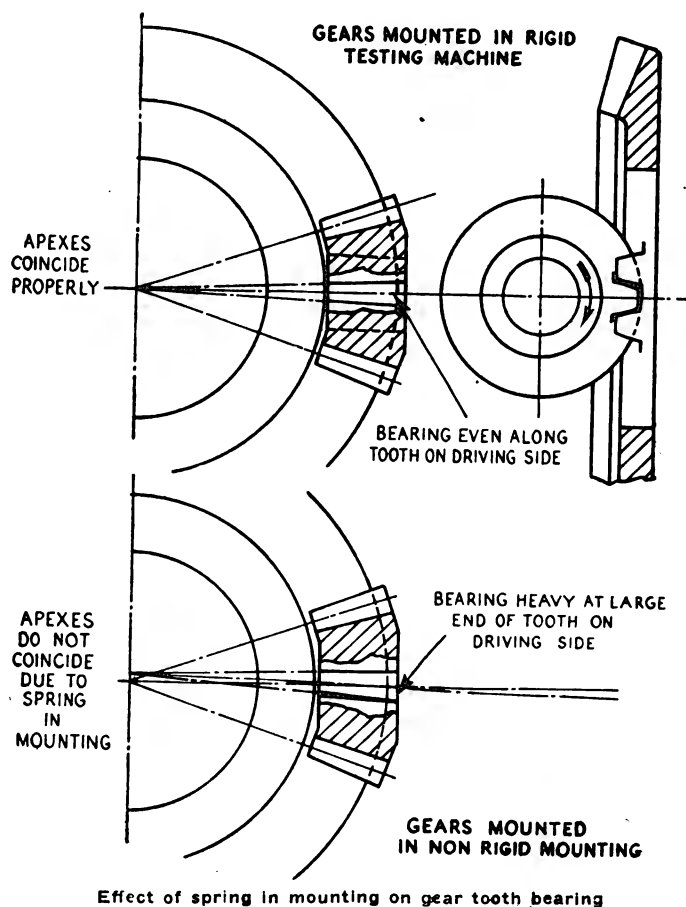
Tooth bearing—rigid and non-rigid mounting

direction for a minute. In the case of the automobile rear axle driving gears the rear axle should first be raised to have the wheels clear the floor, then start the motor and drive the wheels in both directions with the brakes applied to obtain the necessary load.

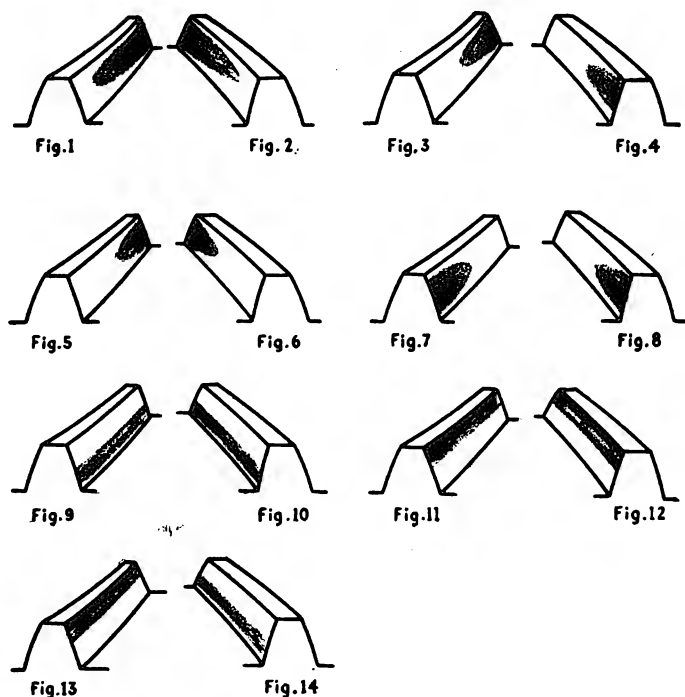
All figures show the bearing on the gear tooth. With a right-hand spiral bevel gear (mating with a left-hand spiral pinion) mounted in an automobile, the driving side is on the convex side of the tooth and the concave side of the tooth is used when in reverse.

The tooth bearing, both lengthwise and profile, should appear as shown in Figs. 1 and 2 (see next page), but a condition of tooth contact may be obtained as indicated in Figs. 3 to 14. The lengthwise bearing adjustments will first be considered.

Lengthwise Bearing Adjustments.—Figs. 3 and 4 show what is called a cross bearing and is caused by either a misalignment of the mounting or an error in the cutting. The mounting should be tested and if found faulty, should be corrected. If the drive side has a toe



Effect of spring in mounting on gear tooth bearing



Examples of bearing on gear tooth

bearing and the reverse a heel bearing, the gears are serviceable provided the bearing is about $\frac{1}{8}$ of the tooth length, but if the heel bearing occurs on the drive side, it should not be used and the cutting conditions should be altered if the mounting is found correct.

Figs. 5 and 6 show a toe bearing on each side of the tooth, and the gear must be moved away from the pinion to increase the lengthwise bearing, which on ratios 1-1 to approximately 4-1 will change the profile bearing to some extent and an adjustment of the pinion may be required as described under "Profile Bearing." This movement of the gear will introduce more backlash and the gear cutting should be changed to properly locate the bearing if this increase in backlash becomes excessive.

Figs. 7 and 8 show a heel bearing on both sides and the gear must be adjusted toward the pinion to increase the lengthwise bearing, which on ratios 1-1 to approximately 4-1, will change the profile bearing to some extent and an adjustment of the pinion may be required as described under "Profile Bearing." This movement will decrease the backlash and the gear cutting should be changed to properly locate the bearing if there is insufficient clearance.

Profile Bearing.—Figs. 9 and 10 show a low bearing on gear tooth which may appear at any position along the tooth. The pinion should be moved away from the gear, and on ratios 1-1 to approximately 4-1, the gear should be moved towards the pinion to maintain the proper backlash. This movement of the gear will alter the lengthwise bearing and several adjustments for both lengthwise and profile bearing may be required to obtain the proper tooth bearing.

Figs. 11 and 12 show a high bearing on gear tooth which may appear at any position along the tooth. The pinion should be moved towards the gear and on ratios 1-1 to approximately 4-1, the gear should be moved away from the pinion to maintain the backlash. This movement of the gear will alter the lengthwise bearing and several adjustments for both lengthwise and profile bearing may be required to obtain the proper tooth bearing.

Figs. 13 and 14 show a lame bearing. It is possible to adjust the gears and obtain a fair driving condition as indicated in Fig. 1, but a poor coast or reverse, and the

only method of completely eliminating the trouble is to properly cut the gears.

It must be borne in mind that the adjustments cited should be moderate and if great amounts of adjustments are needed, the mounting and gear cutting must be carefully checked, and the necessary steps taken to correct the trouble in the manufacture of the gears or mounting.

After a brief discussion the recommendation with respect to backlash was adopted as a standard for future design and the recommendation respecting mounting of bevel and spiral bevel gears as recommended practice.

On Friday morning a number of committee reports were received and the rest of the day was given over to a visit to Niagara Falls. A certain amount of discussion followed the report of the Committee on Uniform Cost Accounting made by J. H. Dunn. Mr. Dunn pointed out that his committee had made a report at every meeting in the last four and one-half years and yet there were 44 members who had never indicated either disapproval or approval of the recommendations made. He made the suggestion that possibly there should be district committee workers on the subject, or that the Association might consider the employment of a special accountant to give his entire time to the Association and travel from plant to plant. Mr. Hamlin suggested that Mr. Dunn meet the Executive Committee to discuss with it measures calculated to increase interest in uniform cost keeping.

Gear Strength Testing Machine

In his report on composition gears, Mr. Christensen elaborated on what he had said on the day preceding, viz., that some work was under way toward developing a machine for testing the strength of gears. In this connection a letter from Prof. Henry A. Wolsdorf, of the University of Cincinnati, was put into the records. At the present time a machine is being designed at that institution for determining the pitch line load required to break off gear teeth. When the design is completed and has been approved by several competent engineers it will be built, provided funds are available for the purpose. Tests will then be made on this machine to establish the relation between this load and the pitch, pressure angle, velocity at pitch line, length of arc of action, width of face, characteristics of material and nature of load (constant or sudden impact). Many gears will have to be broken before all these relations are accurately established. Seven years ago Wilfred Lewis built a gear testing machine for the University of Illinois, but this machine has never been used, being faulty because of excessive friction, lack of flexibility and speed. It is therefore desirable to design another machine to overcome these objections. The objects are entirely educational and results would be published for the benefit of all interested in gear problems.

All Officers Re-elected

As members of the Executive Committee J. B. Foote, Foote Bros. Gear & Machine Co., Chicago, and E. J. Frost, Frost Gear & Forge Co., Jackson, Mich., were re-elected for three years, and C. F. Goedke, William Ganschow Co., Chicago, and W. H. Phillips, R. D. Nuttall Co., Pittsburgh, were elected members for three years. They, in turn, in an organization meeting, returned as officers: President, F. W. Sinram, Van Dorn & Dutton Co., Cleveland, Ohio; First Vice-President, R. P. Johnson, Warner Gear Co., Muncie, Ind.; Second Vice-President, B. F. Waterman, Brown & Sharpe Mfg. Co., Providence; treasurer, F. D. Hamlin, Earle Gear & Machine Co., Philadelphia. Mr. Hamlin was elected secretary a year ago for a term of two years.

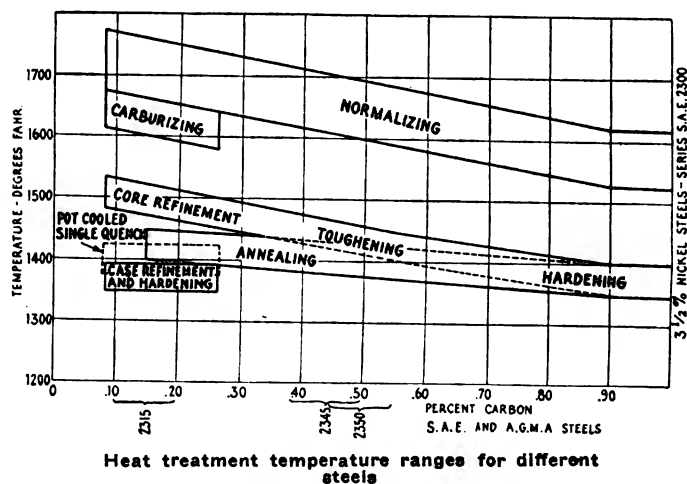
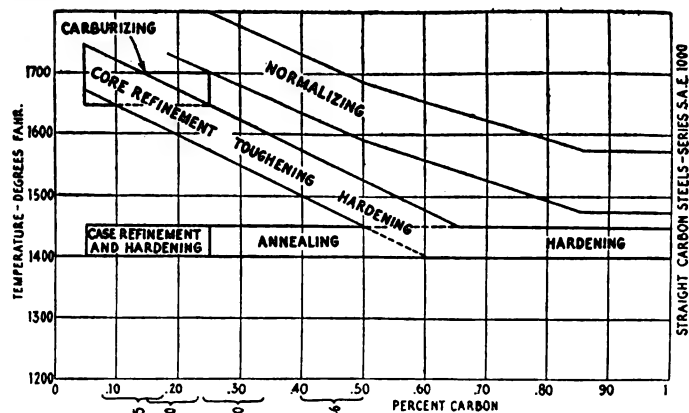
At the dinner Friday evening John C. Bradley, of Pratt & Letchworth Co., Buffalo, asserted that excessive taxation was throttling business, but he emphasized that, notwithstanding unfavorable legislation, "we are well on the road to recovery." "Of course," he said, "those accustomed to wartime prosperity may not be satisfied with the volume of business in the immediate future, but compared to a pre-war average, it is more than satisfactory. Sane prosperity is ahead as contrasted with wartime excesses."

At the Saturday morning session several more reports by standardization subcommittees were presented. Lars Nilson, reporting for the Keyway Committee, said that he had only a progress report to make. A great many tables of key and keyway sizes had been published and while most of them agreed pretty closely in regard to width of key, they were not in very close agreement with respect to depth of keyway. At present, sentiment seemed to favor the use of square keys for shafts up to 3 in. diameter and of flat keys for larger shafts. The A. G. M. A. was one of the sponsor bodies, together with the A. S. M. E. and it was necessary to bring about agreement between the committees of these two bodies. The A. S. M. E. had recommended a double standard, covering both square and flat keys for all sizes of shafts. The A. G. M. A. Committee was of the opinion that there should be only one standard key for any given size of shaft and recommended square keys for shafts up to 3 1/4 in. diameter and flat keys for larger shafts. The committee in a table it had worked up also gave sizes of flat keys for shafts up to 3 1/4 in. diameter and for square keys for larger shafts, but wanted to designate these keys as a second choice and not as the standard. In the case of the flat keys, the depth of the key was taken as equal to the nearest 1/16 in. size to two-thirds of the width of the key. Tolerances for keys and keyways were also given in the table and these agreed with the tolerances adopted by the British Engineering Standards Committee and the proposed A. S. M. E. standard. The only difference between the A. G. M. A. committee recommendation and the A. S. M. A. proposed standard was that the latter called all of the sizes of keys listed, standard keys, whereas the A. G. M. A. proposal was to call square keys for up to 3 1/4-in. shafts and flat keys for shafts above that size, standard, and the rest of the keys listed, second choice. Upon discussion it was decided to have the report multigraphed and distributed to the members for their comment.

In the absence of Chairman C. R. Weiss, the report of the Sprocket Committee was made by S. O. White. Mr. White said that it had been found necessary to make a slight revision in the form of the standard sprocket tooth adopted at a previous meeting. It was necessary, however, to co-operate with the corresponding committees of the S. A. E. and the A. S. M. E. and the committee expected to have something definite to report at the meeting next fall.

C. B. Hamilton, Jr., reported for the Metallurgical Committee. In connection with this report a couple of charts giving the heat treatment temperature ranges for different steels, based upon the carbon contents of the steels, were presented. Mr. Hamilton said that charts for all of the A. G. M. A. steels based on the S. A. E. recommendations recently published were being prepared.

The Metallurgical Committee made the suggestion that the term "cast steel" be dropped in connection with gear steels, owing to the fact that it is much used for designating certain kinds of tool steel, and that the term "steel casting" be used instead. It was also suggested that the term "cast iron" be dropped and the more spe-



Heat treatment temperature ranges for different steels

cific terms "gray iron" and "white iron" be used instead. It was further suggested that the term "semi-steel" be abandoned and that the material referred to be described as gray iron with a certain amount of scrap steel. In the discussion it was asserted that the use of the term "cast iron," which was so firmly established in the industry, could not be readily discontinued. On the other hand, there has been a great deal of objection to the use of the term "semi-steel" which has always been regarded as a misnomer. Both the S. A. E. and the A. S. M. E. were opposed to the term. There are now no established specifications for this material, but the S. A. E. is planning to draw up such specifications. Mr. Frost said that his firm commonly used such expressions as 40 per cent semi-steel, which meant gray iron with 40 per cent of scrap steel added, but he admitted that it was poor terminology as a material could not be both "40 per cent" and "semi."

The report also included a test for steel castings. It was proposed to grind and etch a section of the casting and then examine it with respect to grain structure and the requirement was to be made that the coarse structure characteristic of unrefined cast steel must be completely absent. In this connection some discussion arose on the point as to just how this test was to be carried out. Some members feared that if the gear makers were to be too strict with the steel founders it would result in an increase in price. On the other hand, the opinion prevailed that, inasmuch as gear makers were held responsible for the material in their gears by their customers, they, in turn, must hold the suppliers of this material responsible. One member mentioned that the Bethlehem Steel Co. had arranged to test every ingot in substantially the same way as suggested by the Metallurgical Committee. The test could be made by very simple

apparatus, without the use of a microscope, and was in no way burdensome. Upon the matter being put to a vote the steel casting test specification was adopted. Mr. Hamilton also made a motion for the adoption of the nomenclature recommendation, but owing to the opposition developing withdrew it, with the understanding that the terms "cast iron" and "semi-steel" be avoided as much as possible.

As another part of the report of the Metallurgical Committee S. P. Rockwell read a paper on Recommended Practice in the Selection, Test and Use of Carburizing Materials and the Design of Carburizing Pots. We expect to print this paper in an early issue of AUTOMOTIVE INDUSTRIES.

Gear Grinding

At the closing session on Saturday afternoon R. S. Drummond, vice-president of the Gear Grinding Machine Co., read a paper on The Grinding of Gear Teeth and Its Future in the Industry. He pointed out that it was the demands of the automobile industry for gears that would run quietly at high pitch line velocities which led to the introduction of gear grinding. So far, the greatest number of gears with ground teeth had been used in automobile construction, but gear grinding was now being introduced in other lines of work. For instance, some gears are now made of high manganese steel containing approximately 13 per cent manganese. This alloy steel is so hard that it can be machined only by grinding. The driving gears of gear-driven locomotives and of multi-engine airplanes are also being ground. There are two classes of gear grinding. In some cases gears which originally were not intended to be ground, are so greatly distorted by the heat treatment that they are very noisy and may then be salvaged by grinding their teeth faces.

The second class of gear grinding is the finish-grinding of gear teeth which have been rough cut and have had sufficient stock left for grinding. This constitutes the largest volume of gear tooth grinding to-day. The gear grinding process was originally introduced about 12 years ago, but up to a year ago its chief use was for salvaging gears that had been ruined by distortion in heat treatment.

The question was asked whether the grinding entirely took the place of finish-cutting, to which the answer was in the affirmative. One of the members mentioning that he had a couple of the Gear Grinding Machine Company's machines, another member asked whether he might infer from this statement that the machines could now be bought. Mr. Drummond replied that he was not prepared to announce a definite policy on this point, but that they had, in the past, placed a small number on machines where they thought they could expect skilled and conscientious operation.

A. C. Bryan, chairman of the Transmission Committee, which was constituted at the Rochester meeting last fall, had only a progress report to make, but promised that there would be something definite at the next meeting.

Differential Gear Standards

S. O. White, chairman of the Differential Committee, which was also constituted at Rochester, said that his committee had started by working out a standard nomenclature for differential gears. They took as a basis the S. A. E. nomenclature, but made several recommendations differing therefrom. One of the new terms recommended is that of "complete differential," which covers the differential gear proper together with the rig gear and driving pinion. This part of the report was ac-

cepted as a progress report. Mr. White said that the committee was almost ready to circularize the Association with respect to two complete designs of differential gear. These are both of the four-pinion type and contain gears of the 20 to 11 and 18 to 10 sizes, both of 5-7 pitch. These are the two sizes in most common use on passenger and light commercial cars, respectively. The committee, therefore, plans to develop design of differential gears that are completely standardized, thus carrying standardization a little further than it has ever been carried before in automotive work. Later they expect to work out designs for other sizes as well.

H. J. Eberhardt made a report for the Tooth Form Committee. Special attention was given by this committee to the problem of standardizing the stub tooth and a questionnaire was sent to all members for the purpose of getting their views on the subject. The members were asked to consider a stub tooth having an addendum of 0.8/D.P., a dedendum of 1/D.P., a working depth of 1.6/D.P. and a pressure angle of 20 deg., which in these respects coincides with the A. G. M. A. standard herringbone gear tooth section in the plane of rotation. Of 13 replies received 8 favored the proposal and 5 opposed it. The reason the committee took up the stub tooth first was that they were asked by the Netherlands Committee on Tooth Form Standardization to take up this work. The Netherlands committee, in making this proposal, aptly remarked that the cost of making new cutters and of carrying two or even three sets of different cutters during the period of change-over loomed very large. The report was accepted.

Standard System of Bevel Gearing

The last item on the program was a paper on the Gleason Works system of bevel gears by F. E. McMullen and T. M. Durkan. The Gleason Works showed to the A. G. M. A. at its meeting in Rochester last fall a new system of gears which they had worked out and which they intended to offer to the A. G. M. A. as a standardized system of bevel gearing. The system then presented was worked out with a view to securing maximum rolling and minimum sliding action. It was found, however, after a number of samples had been made and tested out in practice, that they were rather more noisy than gears made to the old designs. The system was, therefore, discarded and a new system designed chiefly with a view to silent operation, and it was this system which was explained at the Buffalo meeting.

Mr. Durkan, who read the paper, pointed out that the bevel gear systems now in use were based entirely upon spur gear practice. In the design of a spur gear system, the great object in view was interchangeability of gears of all sizes from 12 teeth pinions to a rack, and in order to attain this object sacrifices in respect to other desirable qualities were made. Now, in bevel gears there is no interchangeability, as for a right angled drive a bevel pinion will mesh properly only with a gear specially designed for it, and the sacrifices made in order to insure interchangeability in the spur gear system, therefore, bring no corresponding advantage here. One of the requirements of interchangeability is a constant pressure angle for all sizes of gears. This, therefore, has been abandoned in the new system of bevel gearing, and three different angles are used, of 14½, 17½ and 20 deg. Mr. Durkan explained the complete system, using a number of diagrams illustrating it. We expect to reprint his paper in an early issue of AUTOMOTIVE INDUSTRIES. It is planned to get this system ready for presentation as a proposed A. G. M. A. standard for the next meeting.

Some Recent Developments in the Motor Bus Field

The new twenty-passenger G. M. C. bus and a new model twenty-three-passenger Duplex bus are described and the chassis compared with the truck chassis of which they are modifications. Particulars regarding a Canadian double-deck body and some bus materials and parts also given.

A NEW twenty-passenger bus has recently been brought out by the General Motors Truck Co. The bus is mounted on a chassis which has been especially adapted to this type of body, and it is carried on 36 x 6-in. cord tires all around. In designing the chassis, by combining a long wheelbase with long, flexible semi-elliptic springs, easy-riding qualities have been secured. The body overhangs the frame but slightly, and this, it is claimed, eliminates much of the side sway and whipping which have been common with buses with a wheelbase which is considerably shorter than it should be for a long body. The frame on the new chassis overhangs the rear axle by only a few inches.

The powerplant is the same as that used in the G.M.C. two-ton truck. The engine is governed to permit maximum speeds of 30 m.p.h. In test, the bus, fully loaded, was driven at 25 m.p.h. up a 4 per cent grade on high gear. The G.M.C. 4 x 5½-in. engine, which has been described in these pages, incorporates features such as removable cylinder sleeve, removable valve lifter assemblies, pressure lubrication, hot-spot vaporization, etc.

Aside from the engine, the chassis is comparable in most respects to that used in the G.M.C. one-ton truck known as model K-16, but has a much longer wheelbase, 178 in. as compared to 132. This necessitates deeper side members in the frame, these being ¼ x 5⅞ as compared to 5/32 x 4½. The front springs are 4 in. longer and are made of alloy instead of carbon steel. The use of 36 x 6-in. instead of 34 x 5-in. tires, together with the deeper frame and the different spring characteristics makes the top of the frame about 4 in. higher above the ground than that on the one-ton truck. Other differences include the use of a larger gasoline tank, larger radiator, a center bearing on the longer propeller shaft, a large steering wheel and certain additional equipment such as a vacuum tank, speedometer and Klaxon horn.

Interchangeable brake rods are employed to make it possible to use both the internal and external sets of brakes for foot operation. The bus is provided with radius rods which take the drive and hold the axle in a fixed position so that braking conditions are the same, regardless of the load in the bus. The bus chassis will be sold alone in cases where special body equipment is demanded.

The bus body is furnished with two seating arrangements, one adapted particularly to interurban bus operation and the other designed for city passenger work. The body is built of oak reinforced with metal and is

finished outside in smooth-panelled surfaces. The bus has been built with a width of 47 inches and the seating arrangement has been made to correspond with this width without sacrifice to comfort or balance. The interior of the bus is finished in panelled oak, with rattan seats. The equipment includes non-rattling adjustable windows, complete buzzer signal system, front entrance door controlled from the driver's seat, rear emergency door, rear vision mirror, dome lights and an advertising card rack. The fuel tank is located outside and is filled from outside without inconvenience or fire risk.

The Duplex 23 Passenger Bus

Another model of bus has recently been announced by the Duplex Truck Co., which has furnished, among other installations, a large fleet of buses for use in Washington. The chassis used is identical in most respects with that used in the 2½-ton Duplex truck, but it has a slightly shorter wheelbase (160 in.) made necessary by the use of a different axle. The frame length is the same as that on the truck but because of the more uniform loading, a 5-in. instead of a 6-in. frame is employed, ¼-in. stock being used in both cases. The truck is equipped with a No. 4 Vulcan rear axle, 40 x 8-in. tires in rear, and 36 x 6-in. pneumatic front. The bus chassis is equipped with a model W-103 worm drive, Sheldon rear axle, the rear tires being 38 x 7-in. and the front 36 x 5-in. pneumatics.

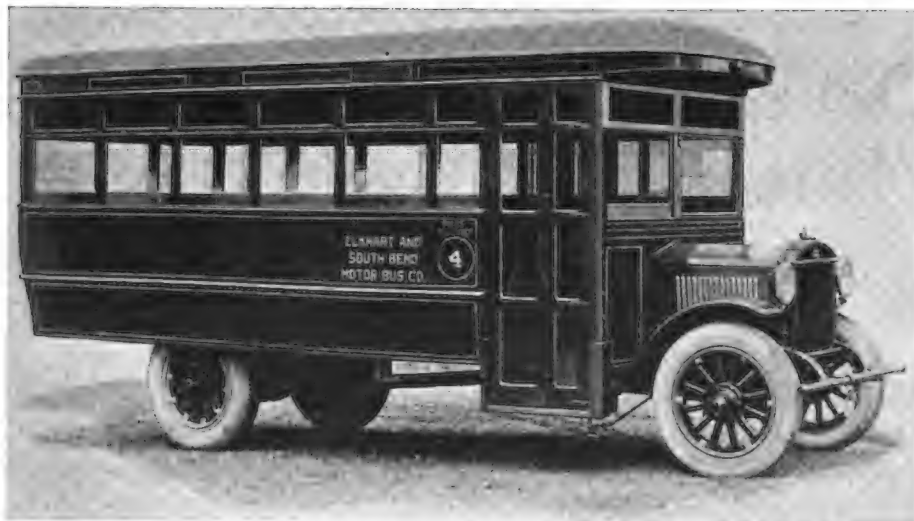
A Hinkley 4 x 5¼-in. four-cylinder engine is used in both chassis, the governor being omitted in the case of the bus engine.

The gear ratio on the bus is 6½ to 1; on the truck it is optional. The gage of the rear wheels in the case of the bus chassis is 62 in., or 2 in. greater than in the truck.

Other specifications of the bus chassis are as follows:



G. M. C. twenty-passenger bus



New twenty-three passenger Duplex bus

Wheels, artillery type; brakes, both internal expanding on 18-in. rear wheel drum; two-unit starting and lighting system and battery ignition; fuel tank of 25-gal. capacity, feed by vacuum tank; multiple dry disk clutch; four-speed gearset; worm and nut steering gear. The equipment includes: Motometer, speedometer, electric horn, Alemite lubrication, front bumper, Gabriel snubbers front and rear, and power tire pump.

The body is of hardwood, with steel reinforcements. Side panels are of steel and the roof of agasote and aluminum covered with oiled duck and painted white on the under side. The seating capacity is for 23 passengers. The operator's seat is in a vestibule separated from the passenger compartment by glassed-in partitions. The folding front door is 25 in. wide and a rear emergency exit door is provided. Headroom is 6 ft. 4 in.

Standard body equipment includes: advertising racks, ventilators, exhaust heaters, lights in domes, fare register, fare box and mechanical door opener.

Double-Deck Bus in Canada

A double-deck bus has recently been constructed in Canada for the Toronto Transportation Commission. The chassis was constructed by the Eastern Canada Motor Truck Co. and is assembled from the following units: Buda four-cylinder engine, Clark internal gear axle, 36 x 10-in. Morand demountable cushion rear wheels and special nickel steel frame, designed to give as low steps as possible. The wheelbase is given as 186½ in. and the track, center to center of rear wheels, as 74⅓ in.

The body is manufactured by the Ottawa Car Mfg. Co., Ltd., who furnish the following particulars:

This bus is similar to those adopted in Toronto, New York City and Detroit. The main idea in design was to adopt a low-hung chassis which has been specially built, giving only two steps into the body of the bus. Heights being, rear 17 in. from ground to platform, 11 in. from platform to body, front steps 13 in. from ground to first step, and 13 in. from step to body floor. There is a winding stairway leading to an upper deck, capable of seating 30 passengers. The height from the ground to the upper deck side rail, which is the highest point of the bus, is 10 ft. 9 in.

All seats in upper deck are of wood slat design, as they are exposed to the weather. Wood slats are also installed over the canvas on the roof.

The interior rattan upholstered seats are capable of seating 21, seven cross seats, one single cross seat at the front and two longitudinal seats at rear. Cushions and

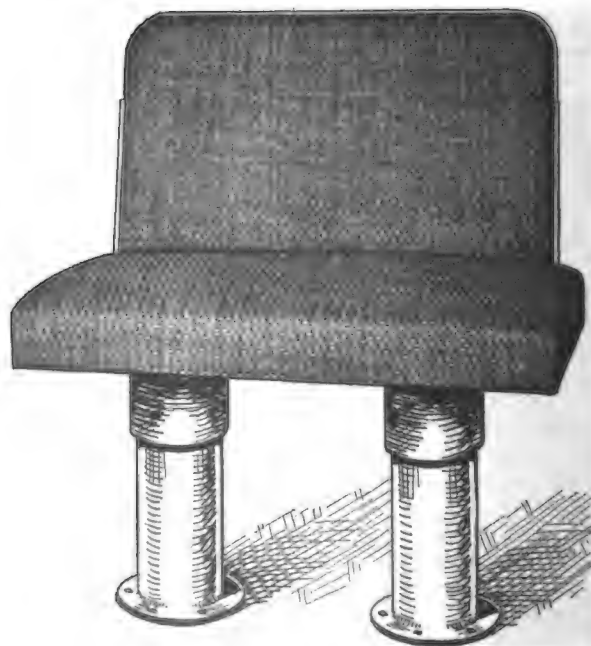
backs are fitted with the Ottawa Car Mfg. Co.'s toggle spring.

The interior agasote ceiling is painted ivory, agasote waist panels painted green, woodwork mahogany stain.

Seven flush dome lights are installed in the ceiling, some of four and some of nine candlepower. Wood slats are installed on the floors and push bells are provided on each side post on the lower deck and side rail on upper deck. Communication between conductor and motorman is by a hand bell and vice versa by electric bell.

Drivers' quarters are comfortably fitted with pantasote trimming, cushion spring upholstered and stuffed back, giving ample room for operating steering apparatus and levers.

This bus, the first of its kind built in Canada, is convertible for one-man operation if required. It has a front entrance door which can be operated by the driver from his seated position by a simple arrangement of levers. All working parts of door are mounted on ball bearings making it easy to operate. A small door is installed to the left of the driver for his convenience and double automatic sash on the left hand which can be opened in warm weather. The sash in front of the driver has no top rail to obstruct his vision, when it is in a lowered position. This sash can be lowered 12 in. by automatic locks. All side sashes drop into pockets, making a comparatively open bus for summer service. Trap doors are installed to facilitate access to gearset. Four ventilators, two on each side, are installed on the upper sash for winter use. Curtains are of double-face Fabrikoid installed on all-metal rollers and have pinch handle fixtures. A conductor's seat, which is adjustable to height and swings under the stairs when not required, is installed on the rear platform. Two signs indicating route and destination are installed in front over windshield, also two in the two upper rear sash on the door side. Perfection heaters are provided under four cross seats regulated from valve installed at the driver's bulkhead. Length of rear platform is 3 ft. 5 in., height lower deck floor to ceiling, 5 ft. 10 in., width at belt rail outside, 7 ft. 4¾



Parker pneumatic bus seat

in., and length of body is 17 ft. 8 in.

Bus Roof and Panel Material

Haskelite, a waterproof plywood, which is molded to form and shipped ready to fasten to top bows is being marketed by the Haskelite Mfg. Corp. This material, which, as we understand it, requires no exterior covering other than paint or varnish, possesses considerable strength, yet its weight, given as 0.89 lb. per sq. ft., is said to be less than that of a slat roof combined with a head lining. Both interior and exterior surfaces are smooth. The interior, being enameled, is easily cleaned by washing. Due to its arched shape and light weight, it is said to withstand vibration better than some other types of roof and to reduce the tendency to swaying by lowering the center of gravity. The roof panels are three-ply and measure 5/16 in. in thickness. Several sizes ranging from 48 by 90 in. to 60 by 144 in. are carried in stock.

The same concern also furnishes "plymetl" for making bus body side panels, which is haskelite faced with thin sheet steel cemented to one or both sides. This material can be readily bent into curved panels and is said to weigh from 25 to 45 per cent less than sheet steel body panels of 20 and 18 gage. In addition, it is said to eliminate metallic drumming, give insulation against cold, increase seating space and decrease cost by eliminating the need for side lining, avoid wavy surface and consequent highlights which sometimes occur with all-metal panels and afford excellent surfaces for finishing and glueing. The panels are 1/4-in. thick, rolled steel face, being sanded and galvanized. Stock sizes are 24, 30 and 36 in. wide and 96 in. long.

A new type of bus seat, the base of which has one or more pneumatic cylinders or dash pots, is being marketed by the Parker Pneumatic Bus Seat Co. The back and cushion are similar in appearance to those used in other bus seats, and are arranged to move together, but the base is formed by a pair of telescoping cylinders held apart by



British folding top bus. Top open and closed

a heavy helical spring which is compressed by the weight of the seat and its occupants. When the vehicle passes over rough roads the cylinders are given an up-and-down motion which is damped by the dashpot action of the air in the cylinder, the air being compressed and forced out of a small hole on the down stroke, with reverse action in returning to normal position. The device is in effect a shock absorber applied direct to the seat, and is said to greatly improve riding qualities.

A Folding Roof Bus

A British manufacturer, Christopher Dodson, Ltd., has recently designed a folding top bus which is so constructed as to be readily transformed from an open to a closed type or vice versa. The main portion of the roof is designated to fold up so that it occupies only a narrow space along the center, while the side windows can be dropped out of sight. The fact that the roof occupies so little space when folded makes it excellent for sightseeing and for touring. Front and rear of the bus are not folding. They serve to protect occupants from undue wind and dust and also to simplify the construction.

Why Lumber Is Steamed During Kiln Drying

THERE seems to be a common impression that the purpose of steaming lumber is to "remove the sap." This is far from being the fact, for when lumber is steamed it takes on moisture, as a rule, instead of giving off anything.

The reason for steaming lumber during drying depends on when it is done, but nearly always the treatment is given for one of the following purposes: (1) To heat lumber through quickly at the start; (2) to relieve stresses which otherwise would produce checking, case-hardening and honeycombing; (3) to equalize the moisture content and condition the lumber ready for use at the end of the run; (4) to kill fungi and insects in the wood.

When lumber should be steamed, how long the treatment should last and what temperature should be maintained are points which have been determined at the Forest Products Laboratory by experiments on many species of wood. A thorough understanding of the steaming operation is essential, because the whole kiln charge can easily be ruined by too severe a treatment.

One of the chief needs of many commercial kilns is proper steaming facilities, without which a high degree of success in the artificial seasoning of wood is impossible.

A NEW type of steel which is highly susceptible to the acquisition and retention of magnetic properties, has been discovered, according to *Chemical and Metallurgical Engineering*, by a Japanese. It has the composition: Carbon, 0.4 to 0.8 per cent; cobalt, 30 to 40 per cent; chromium, 1.5 to 3 per cent; tungsten, 5 to 9 per cent. It is very brittle and very hard, and great care has to be exercised in its manufacture. Its coercive range is about three times that of the best tungsten steel; the area of the hysteresis curve is also three times as great; the permanent magnetism is relatively very high; lastly, shocks and prolonged heating have a negligible effect on the magnetization. In shock tests a slight diminution in permanent magnetism was observed—6 per cent after 850 impacts by dropping from a height of 1 meter on to a cement floor.

Reconditioning Crankcase Lubricating Oil by a New Method

Fuel diluent and water automatically removed from crankcase lubricating oil by a simple refiner which also filters out sediment. Can be installed in any automotive vehicle and operates with splash or force feed systems.

A SYSTEM for automatically removing the fuel diluent and water admixture from crankcase lubricating oil and at the same time filtering out the sediment composed of carbon, sand and metal particles has been developed by a group of engineers and tried out with satisfactory results in the laboratory and also as supplied to truck and tractor engines. It is known as the Gross crankcase oil refiner and was described in a recent paper by William F. Parish read before the Midwest Section of the S. A. E., from which paper the following particulars are taken.

The new system of crankcase oil regeneration consists of four main units, (a) the heating element, (b) the filter, (c) the refiner proper and (d) the cooler. The system is light and simple and occupies about the same space as a vacuum fuel system. It does not interfere with present lubricating systems, functions equally well with splash and force feed systems and can be readily installed in most any type of passenger car, truck or tractor.

Fig. 1 gives a plan view of this system, showing the flow of the diluted oil from the crankcase to the heating element and on to the filter and refiner, whence the oil is discharged to the cooler and back to the crankcase. The force causing the circulation of oil through the system is obtained from the vacuum present in the intake manifold, which ranges from 2 to 25 in. of mercury, according to the type and condition of engine, revolutions per minute, manifold design and other conditions. A tube extends

from the top of the refiner to the intake manifold, through which the vacuum or suction is transferred to the system, and through which the vaporized diluent is drawn off and burnt in the cylinders.

The temperatures shown in the sketch are given as approximately 130 deg. Fahr. for the oil from the crankcase to the heater; 400 deg. Fahr. from the heater to the refiner and 350 deg. Fahr. in the refiner, which temperature, plus the vacuum and agitating effect, quickly removes the diluent. From the refiner at 250 deg. Fahr. the oil passes to the cooler, with a further falling in temperature in the cooler, until the oil will go to the crankcase at about 125 deg. Fahr. The diluent, in the form of a fog or gas, goes into the intake manifold at temperatures up to 200 deg. Fahr., according to the distance of the refiner from the intake manifold.

Operation of the Heater

Heat is taken from the exhaust by any one of several efficient ways. There is sufficient heat in the exhaust under practically every condition of operation to allow of the removal of most of the diluent from the oil. The heater, while in operation, is either filled with oil to the exclusion of air, or is working with oil passing through the heater under the force of a vacuum.

In this way charring of the oil is prevented. The heaters are cylindrical shells slipped over the exhaust pipes, or coils of various designs, either machined or made from tubes or piping, inserted in the exhaust pipe or manifold. Heaters of several kinds have been cut open after thousands of miles of operation and have been found free from carbon deposit.

The refiner, which acts as a distillation flask in the removal of the fuel content from the lubricating oil, is integral with the filter and settling system. The oil comes from the heater to the first filter and settling chamber, where it passes through the screen or filter, from where the cleaned oil is drawn to the still proper and deflected by a baffle to a thin film of heated oil. The combination of the heat and the great reduction in boiling point produced by the vacuum, plus the agitation from the moving vehicle, causes a very rapid vaporization of the diluent. The diluent, in the form of a heated fog, then passes along the vacuum line into the intake manifold, and then to the cylinders, where it is consumed as fuel. The bottom of the still is arranged as a second settling chamber for the collection of such sludge and dirt as pass the first settling chamber and filter. Means are provided to clean out the accumulated dirt when necessary quickly and easily. The still contains the float mechanism that actuated the air and vacuum valves. This part of the system is similar to that employed for the vacuum fuel tanks, which is an item of value in considering service. There is the one feature of interest as influencing the wear of the only moving parts in the system. With the fuel vacuum-tanks the operating mechanism is mostly dry and occasionally covered with a

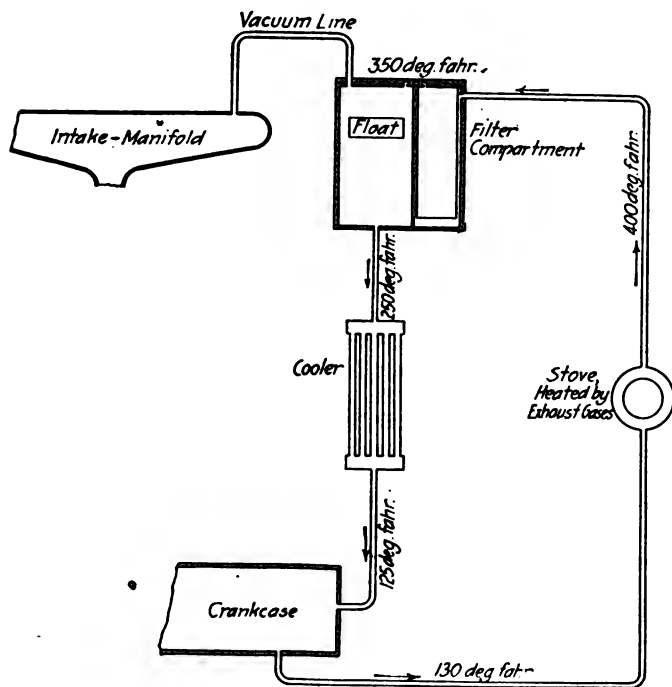


Fig. 1

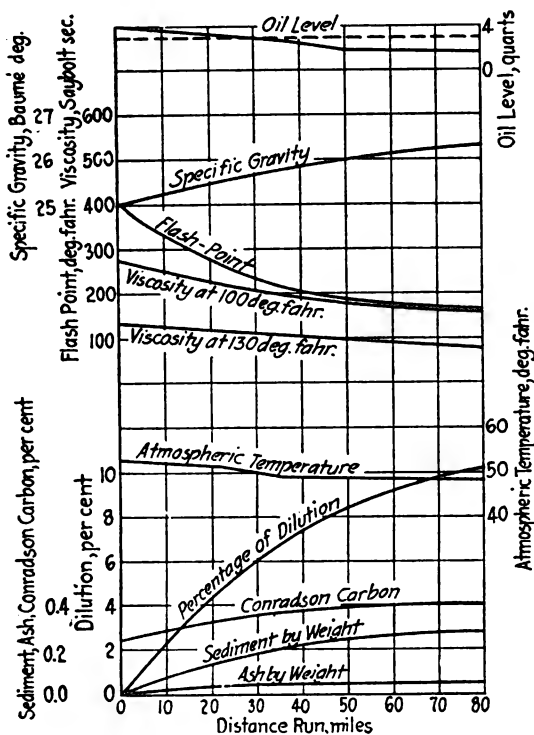


Fig. 2

sulphur powder from the gasoline fumes, while similar parts in this oil refining system are continually covered with oil. The perfectly lubricated parts should, therefore, outlast the engine to which the system is attached.

One of the most important elements in the system is the cooler. The cooler is placed where the air from the fan will dissipate the heat being thrown off from the oil. On engines where there is no fan for cooling, the cooler is placed near the flywheel.

Fig. 2, which shows the characteristics of many comparative tests, indicates the condition of the oil at various periods in the engine of a car operated in city traffic. The oil has become diluted to an extent of 10.2 per cent in 89 miles. The oil was drained and the engine filled with new oil of the same make and grade, some of the former 10.2 per cent diluted oil remaining in the engine and

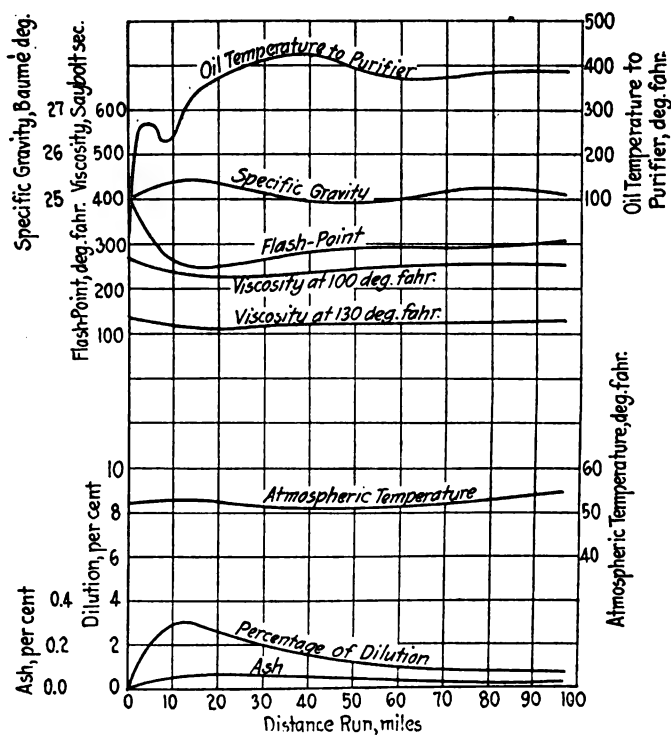


Fig. 3

diluting the new oil about 3 per cent as shown in Fig. 3. After 36 miles the dilution was 1.5 per cent and at 74 miles the dilution was under 1 per cent, where it remained. The viscosity of the oil at the end of the 98-mile run was within 5 sec. viscosity at 100 deg. Fahr., of the new oil. The viscosity remained the same in this engine during subsequent runs to a total of 2180 miles. Occasionally during these runs, which were in city traffic, 1 pint of raw gasoline would be put into the crankcase. This would be taken out of the oil inside of 30 miles. One pint of raw kerosene would be taken out of the oil in about 60 miles. The sludge removed from the bottom of the reclaimer tank generally contains a characteristic sediment of 75 per cent of oil, 12 per cent of carbon and 13 per cent of an ash composed of silica and metal. The ash and the carbon will vary with nature of roads and character of service.

Properties of Steels at High Temperatures

IN Technologic Paper No. 205 of the Bureau of Standards the results are given of a number of determinations of tensile strength, proportional limit, elongation, reduction of area and strength at fracture throughout the range 20 to 500 deg. C. for four steels containing about 0.38 per cent carbon as follows: (a) Plain carbon steel; (b) 3½ per cent nickel steel; (c) 3 per cent nickel and 1 per cent chromium steel and (d) 1 per cent chromium, 0.2 per cent vanadium steel.

Brief reference is made to the types of fractures of steels tested at various temperatures, and particular attention is paid to comparison of the tensile properties of these alloys at 550 deg. C. Of the four steels tested in normalized condition, it appears that the two alloys containing chromium show greater resistance to weakening by increase in temperature to about 550 deg. C. than either the plain carbon or 3½ per cent nickel steels, and at this high temperature the chromium-vanadium steel is to be preferred from the standpoint of high tensile strength and limit of proportionality. The carbon and 3½ per cent nickel steels behaved alike with rise in

temperature above that of the room, and at about 550 deg. C. the addition of 3½ per cent nickel appears to have but little effect upon the strength of the carbon steel.

A summary is being prepared of the data obtained on the various carbon and alloy steels which have been tested in the metallurgical laboratories of the Bureau, including the effects of normalizing rolled-low carbon steel, the effects of 1¼ per cent of manganese, the presence of 5 per cent cobalt, the addition of 0.4 per cent of molybdenum to carbon chromium steel, and the effect of various heat treatments on their properties.

Progress has also been made in determining the effect of time-annealing at blue heat on the properties of cold-rolled boiler plate.

THERE are about 300 farm tractors in Roumania, according to a report received by the Department of Commerce from Bucharest. It is estimated that fully one-half of these are of a popular American make.

Recent Domestic and European Standardization Movements

A collection of items with regard to movements toward standardization in various lines pertaining to the automotive industry in general. Among others are included chains, tires and rims, petroleum, varnish and lumber.

THERE is almost universal recognition of the economic value of standardization within a given plant, and there is also a certain recognition but much less conviction that standardization throughout an industry increases efficiency. It is to this end that the standardization movement tends.

Progress in standardization and the securing of the full measure of economy in manufacture as a result will be greatly aided by the interested parties keeping in touch with the latest developments.

The following items deal with recent standardization movements in the United States and in Europe.

SPECIFICATIONS for the various refined petroleum products purchased by the Federal Government are given in Technical Paper 305, just issued by the United States Bureau of Mines. The specifications cover motor gasoline, aviation gasoline, naphtha, kerosene, signal oil, fuel oils, lubricants, etc. These specifications have been officially adopted by the Federal Specifications Board. They supersede the specifications published in Bulletins 1 to 5, inclusive, of the Committee on Standardization of Petroleum Specifications.

The Interdepartmental Petroleum Specifications Committee replaced the Interdepartmental Committee on Standardization of Petroleum Specifications, which had superseded the wartime Committee on Standardization of Petroleum Specifications. The work of the several committees has been continuous, and the present set of specifications is the result of several years' experience in preparing specifications and drawing up testing methods for petroleum products.

The present set of specifications was prepared by the Technical Committee on Standardization of Petroleum Specifications and adopted by the Interdepartmental Committee on Standardization of Petroleum Specifications, which were the immediate predecessors of the present committee.

The chairman of the Interdepartmental Petroleum Specifications Committee is N. A. C. Smith, of the Bureau of Mines. W. S. James, of the Bureau of Standards, is one of the other members.

Copies of Technical Paper 305 may be obtained by applying to the Bureau of Mines, Washington, D. C.

Silent Chains

At a recent meeting of the Chain Division of the Society of Automotive Engineers Standard Committee, held jointly with the Committee on Steel Roller Chains of the American Society of Mechanical Engineers and the Committee on Sprockets of the American Gear Manufacturers Association, the subject of silent chain standardization was brought up, but it was the consensus of opinion that structural differences between makes prevent the

adoption of a standard at the present time. It was thought that normal silent chain development during the next few years will make standardization possible.

It was stated that to obtain interchangeability of silent chains it will be necessary to standardize the pitch, the included angle, the method of guiding, the width, the maximum radial clearance from the joint over the back of the link, the maximum distance from the center of articulation to the point of the link, the perpendicular distance from the bearing face of the link to the center of articulation and the location of the top of the teeth with regard to the chord connecting the centers of articulation. It was emphasized that the standardization of silent chains is further complicated owing to the actual differences in construction of the chains.

British Tires and Rims

The British rubber tire manufacturers section of the Society of Motor Manufacturers and Traders for some time has been discussing standards for tires and rims and already has adopted certain standards. The subject is being steadily pursued and at a recent meeting, a letter was read from the Association of British Rubber Tire Manufacturers recommending that the British standard list should continue unaltered.

It was resolved to appoint a sub-committee to consider pneumatic tire and rim standards, and another sub-committee was appointed to consider solid rubber tire standards. Reference to the work of the Tire and Rim Association of America concerning standard rims resulted in the recommendation that the pneumatic tire sub-committee should endeavor to confer with rim and wheel manufacturers on the subject of standard rims.

Varnish

The second edition of Circular 103 of the Bureau of Standards, distributed by the Superintendent of Documents, contains a specification for water-resisting spar varnish, and was prepared under the auspices of the Bureau of Standards by the U. S. Interdepartmental Committee on Paint Specification Standardization.

The revision is largely based on criticisms of the first edition made by certain varnish manufacturers' associations. The committee's draft was submitted to numerous representatives of the varnish industry, and careful consideration was given to their suggestions. The specification gives the general requirements and detailed methods of sampling and testing as well as the basis for purchase. The general requirements are that the varnish shall be suitable for use on inside and outside surfaces of vessels, buildings, etc., and must be resistant to air, light, and water.

Circular No. 117 of the Bureau of Standards consists of specifications for interior varnish. The specification states the general requirements and gives detailed methods

of sampling and testing as well as a basis for purchase. In the requirements it is stated that it shall be suitable for general interior use, including both rubbed and un-rubbed finish exclusive of floors; it must be capable of easy application of brush in the ordinary manner according to the rules of good standard products, must flow out to a good level, cut free from runs, sags, pits, or other defects, and dry with reasonable permanence to a hard semi-elastic glossy coating which can be rubbed in forty-eight hours or less.

According to Sir William Tritton, all British steam traction engines, portable engines, etc., are designed to drive at a belt speed of 2200 ft. p. min., and this is equally true of German, Austrian, American and Canadian engines. This standardization, it seems, was arrived at without any convention ever having been held for the purpose, and as a result of it any make of steam traction engine can be used to operate any make of threshing machine. In the British farm tractor trials held recently, the belt speeds, on the other hand, varied between 1830 and 3760 ft. p. min.

Lumber

A movement is now on foot looking to the ultimate formulation of lumber standards, including terminology, sizes, grades and specifications. The movement is being fostered by the American Engineering Standards Committee, the National Lumber Manufacturers' Association and the Forest Products Laboratory, among other organizations. It is expected that a conference on this subject will shortly be called by the A. E. S. C., with whom those interested should communicate, at 29 West 39th Street, New York.

Prior to the war there existed an institution known as the International Association for the Testing of Materials, with headquarters in Vienna and branches in practically every industrial country. It had as its objects the development and unification of standard methods of testing; the examination of the technically important properties of materials of construction and other materials of practical value, and also the perfecting of apparatus for this purpose. From the parent body there had sprung the American Society for Testing Materials in this country, the Deutsche Verband für Materialprüfungen der Technik in Germany and the Italian Society for the Study of Building Materials in Italy. In England there existed a branch of the International Association, and a

movement to establish a national society for the testing of materials was on foot when the war intervened and put a stop to the efforts. Now, however, a new movement has been launched to organize a British association.

Following is a complete list of automobile standards issued to date by the British Engineering Standards Association: Spark plugs; screw threads, nut and bolt heads; tungsten filament lamps; pneumatic tire rims; wheel rims and tire bands for solid rubber tires; charging plug socket for electric vehicles; wrought steels; magnetos; body spaces and frame ends; ball journal bearings; rubber tires for British standard rims.

Gage Steels

An informal meeting was recently held in New York for the purpose of considering improved specifications of composition and the heat treatment of gage steels. The meeting was arranged by the Ordnance Department of the United States Army and was well attended by steel makers, gage makers and gage users. A subcommittee was appointed to arrange and carry out a comprehensive program with a view to determining, first, the physical characteristics required of gage steel, and, second, the composition and heat treatment necessary to produce these characteristics. The active co-operation of Government research agencies, standardizing bodies, gage makers and users is contemplated by the committee in the program to be undertaken.

The specifications and tolerances for liquid measuring devices adopted by the preceding conference were reviewed by the Fourteenth Annual Conference of Weights and Measures held some time ago and several changes were made, the advisability of which was indicated by the experience gained during the preceding year. New tolerances were adopted, 2 cubic inches being allowed on deliveries of $\frac{1}{2}$ gallon or less, 3 cubic inches on a single gallon, and 1 cubic inch per gallon additional in case of deliveries of more than this amount.

A recent meeting of the National Screw Thread Commission, held at the Bureau of Standards, was directed chiefly to a consideration of tap drill sizes and tolerances and dimensions and tolerances for nuts, bolt heads and wrenches. Some consideration was also given to the question of wire and sheet metal gages. Matters under consideration were referred back to subcommittees for a continuation of the work, and these committees will report at the next meeting.

Welding and Cutting Blowpipes

A THOROUGH investigation of oxyacetylene welding and cutting blowpipes was recently conducted by the Bureau of Standards at the request of the War Department. Apparatus from 14 different manufacturers was submitted to test, and the character of the test was decided upon only after a thorough study had been made of the various operations in which these blowpipes are used.

The tests to which all the blowpipes were submitted were developed with the idea of minimizing the personal equation of the operator and securing data which were representative only of the blowpipe itself. In order to accomplish this result, a rather elaborate testing equipment, consisting of a weighing system, gage board equipment, welding table, cutting table and safety flashback testing apparatus was designed and used throughout the investigation.

This investigation is fully described in Technologic

Paper No. 200 of the Bureau of Standards, which describes in detail the various parts of the equipment and then considers the different classes of tests which were used for the cutting and for the welding blowpipes. The conclusions arrived at as a result of this work should prove of considerable assistance in improving the design of apparatus of this kind, with the object of securing better work, greater economy and increased safety to the operator.

THE German Minister of Finance has given notice that owners of automobiles equipped with electric generators for lighting purposes are not entitled to receive duty-free light mineral oils. The notice does not specify what class of consumers are entitled to the duty-free fuel—owners of automobiles without lighting generators or owners of stationary lighting plants comprising a liquid fuel engine.

Methods Used in Specialized Production of Cast Iron Pistons

Some original processes used in the production of light weight, cast iron pistons. The foundry cores are machine made. A description of the aging process and machining and inspection methods. It is claimed that the pistons are held to a tolerance of plus or minus 0.0005 in.

By J. Edward Schipper

IN making a study of production methods in use on automotive parts, it is worth while to note those in use by some of the parts specialists. There are a number of very interesting manufacturing establishments in the automotive field which specialize on one particular part and have a production sufficiently large to enable them to sell their products to manufacturers of the complete unit at a price which is less than it would cost the manufacturer to make the part himself. Often, too, these specialists take a unit and carry it to a higher state of development than it has attained in the art generally, and in that way are enabled to sell it at a price somewhat higher than what the standard article would cost the manufacturer of the complete unit to produce.

This specialized parts business is interesting from a production standpoint, because it affords opportunity for a comparison between the methods in use in such plants and those in use in plants manufacturing the complete car unit. When the production of complete engines, for instance, is large, there is very little to choose between the two, but where the production is small it is often possible for the specialist to successfully compete on a price basis, because of the greater output. From a design standpoint the specialized parts business also affords an interesting study, because it often turns out a product which is better from a performance standpoint than products which are used as stock equipment by manufacturers of complete engines or cars.

The Foster Machine Co., manufacturers of turret lathes and screw machines, have for some time specialized on the manufacture of the Foster piston. This is an internally ribbed, light weight, cast iron piston which has been extensively sold for replacement purposes. Some interesting and original processes are used in the production of these pistons. This concern does its own foundry work and delivers the pistons in either a semi-finished or finished condition.

Core Manufacture

In manufacturing the cores for Foster pistons, a patented machine is used, which is illustrated in Figs. 1 and 2. It consists of a six-part box which is mechanically pulled out in segments, as shown. The core box is closed and filled with ordinary core sand, the box is then turned over, the segments are separated and the finished core is deposited upon a plate ready to be put in the oven. A core machine of this type is capable of making 300 cores per 8-hour day. As there are five of these machines now in operation, the capacity of the plant is 1500 cores per day. The box operates on a bell-crank lever system and deposits each core on an independent plate. Cores are baked for 2 hours in an oil oven at a temperature of 300 deg.

The castings are allowed to age for 10 days before machining operations are begun. The usual annealing process is dispensed with, it having been found that the roughing tool for the first operation peens out any internal strains. A heavy cut is taken on this tool, and after leaving it the castings are sufficiently relieved. The machine operations here described are used for all types of piston that are put through this plant. The Foster company makes 110 types of piston at the present time.

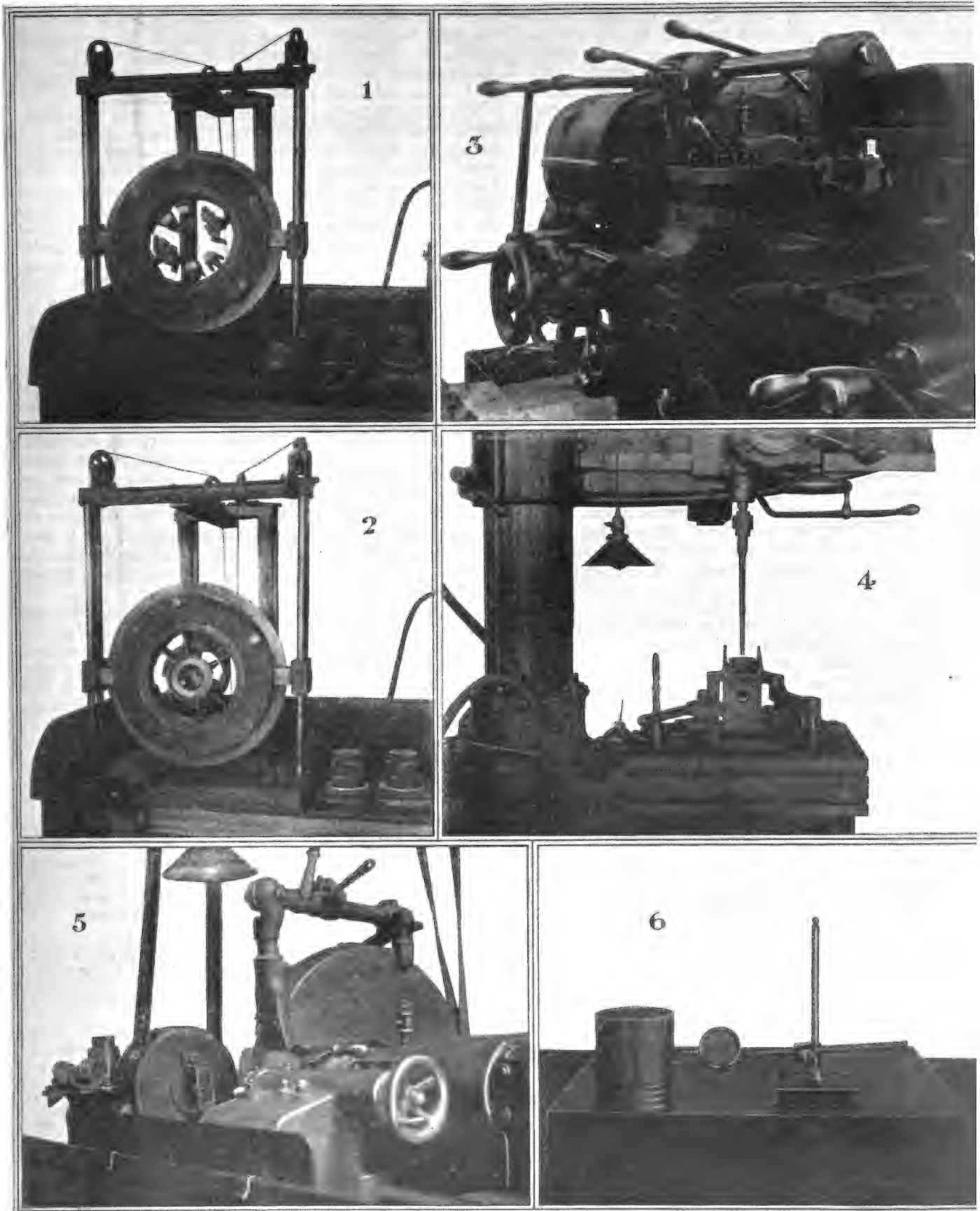
Roughing Operation

In the first roughing operation the piston is chucked at three points inside near the head and three points inside near the open end. It is driven by the piston pin boss. In this operation the piston is rough-turned, the head rough-faced and the ring grooves are roughed out. The work is done on a Foster universal turret lathe made by the same concern that manufactures the pistons. The capacity of the machine, of course, depends on the type of piston manufactured. With a piston such as that used in the Buick model D-45, the machine has a capacity of 22 per hour. This piston is $3\frac{1}{4}$ in. in diameter by 4 in. in length. The machine takes off $\frac{5}{64}$ in. all around or $\frac{5}{32}$ in. on the diameter. This is a very heavy cut and requires a rigid machine. The operation set up and the machine may be seen in Fig. 3. The tool is cooled with water containing soluble oil.

Following the roughing operation, the piston is chucked by means of a Barker wrenchless chuck on its outside diameter. The open end is first rough-faced and rough-bored and then finish-faced, bored and chamfered.

All of this work is done on Foster universal turret lathes. The average time on this work is about 1.8 min. per piston for both the rough and finish operations.

The pistons are then put into a drill jig with a clamp against the open end face and a cam against the head. The work is located by means of V-blocks which fit against the bosses. While in this jig, the piston pin hole is rough drilled, allowing $\frac{3}{64}$ of an inch for reaming, and the holes are also reamed. The reamer is piloted above and below the piston and in shifting over for the reaming operation, the piston is located in the jig by a drill bushing through the hole, which lines it up for the reamer. A Magic chuck is used for quick shifting over to the reaming tool. The drilling and reaming operations require about 2 minutes per piston. In carrying out this work, the operator puts through both the drilling and reaming operations without taking the piston out of the jig, eliminating any danger of shifting of the piston. Consequently, the reamer is exactly concentric with the drilled hole. The jig with the reamer in position and the drill standing by its side is shown in Fig. 4.



1—Machine for manufacturing foundry cores. Six-part box pulled out in segments. 2—Foundry core machine with core box closed. 3—Foster universal turret lathe set up to rough turn the piston, rough face the head and rough out the ring grooves. 4—Drill jig with reamer in position and drill standing at one side. 5—Modern grinder and piston with adapter inserted into the open end ready to be rough ground. 6—Surface plate for checking the piston pin hole for parallelism with the piston head

In finish-turning the pistons, the casting is clamped against the open end with a pin adapter through the piston pin hole which has just been reamed. In this position it is possible to finish-face the piston head, finish-turn the outside diameter and finish-turn the ring grooves, while at the same time a centering operation establishes the center of the piston in relation to the piston pin hole. This work is also done on a Foster universal lathe and requires 3 min. per piston. Stellite cutters are used for this and the previous cut.

Following the finish-turning, the oil drain holes are drilled and the pistons are then rough ground. In grinding, an adapter is inserted into the open end of the piston, with a pin as shown beside the machine in Fig. 5. This pin contacts with the piston boss and acts as a driver. The piston is placed between centers on this adapter and rough ground to 0.003 in. oversize, with a tolerance limit

in manufacture of plus or minus 0.0005 in. The machine used is a Modern grinder. The finish grind is taken in the same way, requiring only one pass of the wheel back and forth. The pistons are held to a tolerance of plus or minus 0.0005 in. Norton Crystolon wheels are used for both rough and finish grinding.

The usual inspection operations follow. One of particular interest is that for checking the piston pin hole for parallelism with the piston head. The piston is placed upon its head on a surface plate, as shown in Fig. 6. The distance from the surface plate to the top of the piston pin hole is located on an amplifying gage on one side and the amplifying gage is set at zero. The piston is then turned around to the diametrically opposite side and the deviation from the zero point on the amplifying gage is noted. The tolerance at this point is plus or minus 0.002 in. The eccentricity tolerance for the final inspection is 0.0015 in.

Division of Frictional Losses in Engines

THE friction load of a gasoline engine may be determined in an easy and accurate manner by the deceleration method. The principle of this method, which may not be generally known, is as follows:

When an engine is running at its normal speed, a certain amount of energy is stored up in its rotating parts. If the power is then shut off, the speed will gradually decrease, by reason of the energy absorbed by the friction of the various parts, which gives rise to a retarding couple, or friction moment. The value of this moment may be determined if the moment of inertia of the rotating masses and the negative acceleration are known.

Let C_f be the frictional moment in lbs.-ft.

I , the moment of inertia in lbs.-ft.²/sec.

ω , the difference in angular speeds, in radians per second per second

n , the difference in revolutions per second per second

We then have

$$C_f = I \omega = 2\pi I n$$

The values of ω and n are measured by means of a chronograph.

In order to determine the moment of inertia, two tests are necessary, one with the resistance couple C_f alone and the other by applying to the shaft of the machine a known resistance couple C_b . In the first case, if the reduction in the number of revolutions is n_1 we have

$$C_f = 2\pi I n_1$$

In the second test the reduction in the number of revolutions is n_2 , which is greater than n_1 ; and we then have

$$C_f + C_b = 2\pi I n_2$$

From these two equations we derive the following:

$$I = \frac{C_b}{2\pi(n_2 - n_1)}$$

In both tests the power is shut off when the engine is rotating at the same speed n . Then, in order to determine the friction of the different parts, a number of tests are made, first with the machine completely assembled, next with the piston removed, then with the distribution gear disconnected, etc. The tests should be made under normal operating conditions as regards lubrication, speed and temperature.

The engine being completely assembled, it is run at normal speed by the explosion of the gaseous mixture. After the connecting rod head is disconnected, it is run by an electric motor. However, when there are no explosions in the engine cylinder, it is necessary to take

into account the fact that the piston exerts no side pressure against the cylinder wall as a result of the explosion pressure, consequently the total internal losses are not the same as those shown by an indicator diagram taken when idling. In the same way, the reactions of the explosion on the bearings is eliminated. It is necessary to assure uniform lubrication during the tests in order that the various results may be comparable among themselves.

Experiments were made in Australia some time ago by F. P. Taylor with a 6-hp. National, a 40-hp. National and a 30-hp. Crossley engine. The speed was measured by tracing a line by means of an electromagnetic stylus on a card covered with lamp black. In this way it was possible to trace a curve of speeds, and the deceleration was determined by drawing tangents to different parts of the curve.

The results obtained from tests on these engines permitted of a comparison of the individual losses in the different engines, which is made in Table I.

On the average the division of losses is as follows:

Piston friction	45 per cent
Pumping losses	35 per cent
Engine bearing friction.....	14 per cent
Connecting rod	4 per cent
Distribution gear	3 per cent

TABLE 1.

	National	Crossley	Victor
Crankshaft bearings	15	16	11.5
Distribution gear	2	4	1.5
Pumping loss	34	37	37
Connecting rod	4	3.5	5
Piston	45	40	25

While all three of these engines were stationary engines, the distribution of losses in automotive engines would no doubt be very much the same.

A TRADE organization for the British rubber industry has been created, known as the Institution of Rubber Industry. It plans to promote the interests of rubber growers, manufacturers and distributors, and to advance the general standards of the rubber industry. At the inaugural meeting of the new body it was brought out that the rubber industry was substantially a century old; in 1873 the world's production of rubber amounted to 15,000 tons, while in 1919 it reached nearly 400,000 tons.

Traffic Facts Shown by Highway Transportation Surveys

Overloading is prevalent in hauling all commodities. Trucks handle large percentage of manufactured products carried over route covered by surveys. 3.2 passengers per car is average determined. 2-ton trucks form 16 per cent of total. Census an example of needed transport studies.

THE practice of overloading trucks is prevalent in the carrying of all commodities, according to the results of two recent traffic surveys conducted by the Connecticut Highway Department in cooperation with the Bureau of Public Roads. Other interesting data were developed in the surveys which form the beginning of actual studies in the economics of highway transport. Information was developed concerning the percent of total vehicles comprised by trucks of a given weight, the average length of haul of the various commodities, truck weights per inch of tire width, and a comparison of truck and railroad traffic.

While this data cannot be considered as final in any sense, the method and type of the survey illustrates well how the needed information on highway transportation can be compiled and analyzed. For this reason the story of these two traffic censuses are of special value. The purposes of the censuses were to determine the economic value of the highway; the classification of vehicular traffic; the gross weight and wheel loads of motor trucks and the extent of overloading; a basis for the distribution of construction and maintenance costs; density of traffic; width of vehicles and the relation of density and width of vehicles to roadway width; the movement of freight by highway; the speed of vehicles and to serve as a basis for a formulation of traffic regulations.

The first census was taken during the last two weeks of August on the Hartford-Springfield road at the Massachusetts-Connecticut State line. The second census took place during October on the Boston Post road at the town of Greenwich, Connecticut. Each of the censuses covered a period of fourteen days. The daily survey covered ten hours, rotated so as to determine the traffic movement at the earlier and later periods of the day. Two night counts were conducted to form the basis for an estimate of night traffic. Road scales were installed on both roads to weigh the traffic as it passed over the road. At the Greenwich station a 49,000 pound automatic Fairbanks scale was used in order to delay the traffic as little as possible.

During the first census traffic bound south from Springfield, Mass., to Hartford, Connecticut, was weighed whether empty or loaded. North bound trucks were stopped, but only commodity information was obtained. The density of traffic was such that it was impossible to weigh trucks going in both directions. In the second census the east bound traffic from New York was weighed and west bound trucks were stopped only for commodity information. The personnel of the survey included eight men to handle both truck and passenger car traffic. During the second census older men were employed and the results, especially the truck information, were more accurately recorded. Traffic was only slightly delayed by the observers and drivers co-operated willingly when they understood the purpose for which the information was asked.

During the first census the information, including the weight of the truck was obtained in an average of one minute and forty-one seconds, the longest time being two minutes and fifty-five seconds and the shortest one minute. At different times during the census speed tests were made and one of the results of the survey is the indication that a more accurate index of truck speed can be obtained at a place a few miles from the traffic station where drivers will not suspect that the test is being made.

Five forms were devised for use in recording the data, copies of which are attached.

The cost of the first census was \$1,693.10, of which \$977.63 was for the scale, \$170 for the cost of erecting it, and the balance for salaries of the observers. The cost of the second census was \$3,331, of which \$2,700 was for the scale and the balance for salaries of observers, etc.

The report on the censuses is divided into four parts. Part one is in the nature of an introduction. In part two are covered analyses of the best methods of obtaining such information and of the passenger traffic recorded and a study of the extent of truck overloading. Part three deals with an analysis of commodities carried, and part four has to do with a study of the relation of highway traffic observed to railroad traffic in the same section.

Passenger Traffic Analyses

28,011 passenger cars were recorded during the first census and for 14,036 of the cars observed the records were analyzed to determine the average haul, number of passengers, etc. In the second census 38,566 passenger cars were recorded and the records of 5023 were analyzed.

The number of motorcycles and horse-drawn vehicles was so small in comparison with passenger cars and truck traffic that their numbers are not reported.

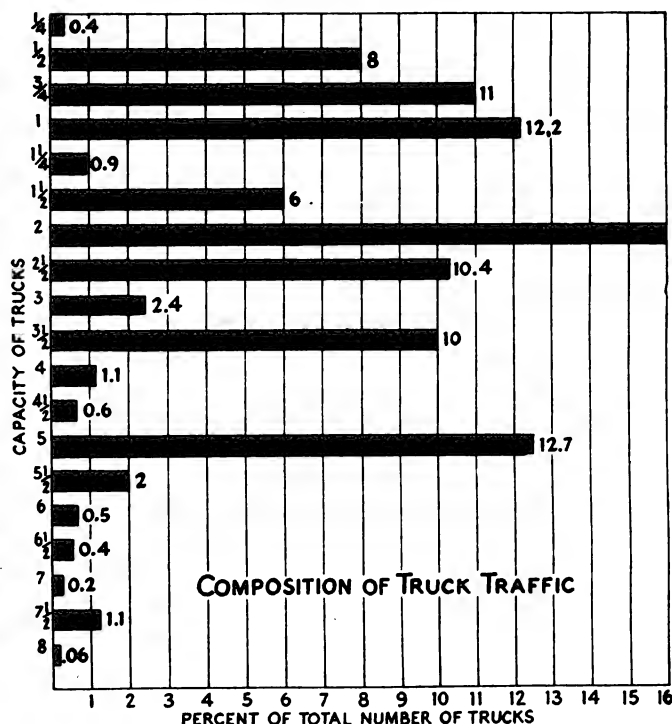
All makes of cars and all types including touring cars, roadsters, and other special types were observed during the census.

44,950 passengers were transported in the observed cars, south bound in the first census. An average of 3.2 passengers per car. During the first census of the licenses observed 50.5 per cent of the total were Massachusetts tags; 34.9 per cent were Connecticut; 7.2 per cent were New York, and 7.2 per cent were miscellaneous.

The location of the census station near the Massachusetts-Connecticut State line and the fact that this analysis relates to south bound traffic accounts for the high percentage of Massachusetts cars.

In the second census the average number of passengers per car was found to be 3.314. The analysis of license tags shows Connecticut with 53.1 per cent; New York 37.4 per cent; Massachusetts 3.2 per cent; New Jersey 3.2 per cent. A daily average of 6739 passenger cars was found for the two censuses while the daily truck average was 792.

The principal movement occurred between seven o'clock



in the morning and eight in the evening, the peak load occurring at five P. M. The hourly density of truck movement from eight P. M. to five A. M. indicates the night movement of regular truck lines. During this interval an average of thirteen trucks passed over the roads per hour.

In the first census the daily average of passenger car movement for twenty-four hours was 2907. The average mileage per car was 70.018 at 3.2 passengers per car, and figuring the value of the passenger service rendered at the railroad rate of 3.6 cents per mile the passenger service on the Hartford-Springfield road during the two weeks was valued at \$327,595.50.

During the second census the daily average of passenger car movement for twenty-four hours was 3832.4. The average mileage was 52.4. Computing the value of the service as above the value for the two week interval was \$355,417.04. On the two roads together the value of the service rendered for a year would be \$17,238,326. This figure is merely the value of the service rendered by these two roads estimating the value at railroad rates. It is not the cost of the service rendered by the roads.

Truck Overloading

The truck weight data from both censuses were analyzed to determine the wheel and axle loads and to ascertain what percentage of the vehicles weighed in excess of the legal limitation of 25,000 pounds, and what part of the traffic consisted of vehicles with wheel loads greater than 800 pounds per inch of tire width, and what proportion of the vehicles was overloaded when gauged by the capacity rating of the manufacturers. The latter practice is referred to as overloading per capacity. The weight standard used in determining overloads for each make and capacity consists of a summation of the manufacturer's 1920 weights for the chassis, body, and rated capacity, giving the total weight when loaded to rated capacity. The percentage distribution of weight recommended by the manufacturers of trucks for front and rear axle load was used as a standard for computing overloads on the front and rear axle. To be conservative 5 per cent of the total chassis, body and capacity weight was added to the manufacturer's given weight in deriving the standard for com-

puting overloads. One half of this 5 per cent was added to the front and rear axle weights in arriving at a standard for measuring overloads per axle.

The practice of overloading per capacity is not confined to loads of heavy material such as sand, gravel, brick etc.

It is restricted to no typical group of commodities, but is almost universal.

Apples, beer, butter and eggs, drugs, fish, furniture, groceries, lumber, meat products, paper, rubber goods, sugar, vegetables, wire are typical commodities of which overloads per capacity were noted.

Of the cases of overloading per capacity observed, 75 per cent was practiced by regular trucking vehicles, 25 per cent by irregular trucks.

Commodity loads exceeding 25,000 pounds were noted in the case of such commodities as brick, butter, drugs, eggs, glass, groceries, litharge, meat, plumbing supplies, sugar, vegetables and vinegar.

Of the number of loads exceeding 25,000 pounds 87.8 per cent were overloads per capacity; 88.7 per cent were by regular trucking companies. Thirty-nine out of 41 cases were loaded from 846 to 1560 pounds per inch of tire width on the rear axle.

Only 4.2 per cent of the trucks observed were over 5-ton capacity. The percentages of other capacities noted were as follows:

Capacity in tons	Per cent of total number	Capacity in tons	Per cent of total number
1/4	0.4	4	1.1
1/2	8.0	4 1/2	0.6
3/4	11.0	5	12.7
1	12.2	5 1/2	2.0
1 1/4	0.9	6	0.5
1 1/2	6.0	6 1/2	0.4
2	16.0	7	0.2
2 1/2	10.4	7 1/2	1.1
3	2.4	8	0.06
3 1/2	10.0	...	...

Width of Truck Bodies

The least width of truck body observed in the two censuses was 5 feet; the greatest width in either census was 9 feet, 6 inches. Only 6 per cent of all trucks observed in the first census and 5 per cent in the second census were equipped with bodies exceeding 7 feet, 6 inches in width.

Pneumatic tires were observed in use principally on the lighter trucks; solid tires on the heavier trucks and a combination of pneumatic and solid on the front and rear wheels respectively principally in the weight classification from 3,000 to 14,000 gross weight in pounds. The use of pneumatic tires increases rapidly from 2,000 to 5,000 lb. and then decreases rapidly to 10,000 lb. The number in excess of 10,000 lb. is negligible. The greatest percentage of trucks equipped with pneumatics occurs in the 4,000 to 5,000 lb. class. Solid tires begin to increase rapidly at 5,000 lb.

The density of movement was found to be between the 4,000 and 14,000 lb. classes, 1,378 out of 2,183 observed trucks falling in these classes. Only 51 out of 2,183 or 2.3 per cent exceeded 25,000 lb. Only 7 out of 2,183 weighed more than 28,000 lb.

In the first census 29 of 2,266 trucks, 12.8 per cent were found to have front axle loads in excess of 800 lb. per inch of tire width.

138 out of 359, 38.44 per cent were found to have rear axle loads in excess of 800 lb. per inch of tire.

167 of 585 or 28.55 per cent were loaded to more than 800 lb. per inch of tire width on both axles.

Overloads on the rear axle range from 800 to 1,100 lb. per inch, density occurring at 900 lb.

Overloads on the front axle range from 800 to 1,650 lb. per inch, density occurring at 1,100 lb.

In the second census the per cent and range of overloads were as follows:

Front axle11.9 per cent, 800-1500 lb., density 950 lb.
Rear axle36.5 per cent, 800-1925 lb., density 1100 lb.
Both axles.....24.6 per cent

In both censuses the number of overloads increases as tire thickness increases to 1½ inches and decreases above that thickness.

The weighted average overload per capacity (computed on basis of standard defined on page 5) is 39 per cent. This is construed to mean that every third truck was loaded beyond the capacity of the truck and tires. A total of 37.5 per cent were overloaded on the rear axle, and 40 per cent were overloaded on the front axle.

Recommendations Based on Overloading Analysis

1. Classification of highways.
2. Seasonal restriction of loads.
3. Prohibition of overloads per capacity, and restriction of tire to 800 pounds per inch width.
4. Maximum body width of 7 ft. 6 in.
5. Maximum axle loads to be determined for each make and class of trucks and placed in conspicuous place on the vehicle.

Commodity Analysis

The 20 commodities noted in greatest bulk in the second census, with the weight and average haul of each, follow:

Commodity	Weight in pounds	Average haul in miles
Groceries	1,039,469	44.15
Furniture	553,545	71.47
Beer	421,665	72.92
Sugar	404,640	47.26
Household goods ...	375,495	99.81
Meat products	334,410	42.75
Rubber goods	279,020	82.96
Vegetables	176,893	37.68
Poultry	159,760	32.67
Cocoa beans.....	158,518	33.12
Merchandise	153,831	42.88
Wire	145,550	66.50
Grapes	141,220	48.56
Bananas	133,627	47.13
Dry goods	133,360	43.79
Feed	131,140	27.10
Silks	125,305	110.22
Lumber	119,805	35.51
Machinery	115,875	89.10
Litharge	114,370	106.25

The longest average hauls reported were those of boats

and yeast, each of which was hauled an average distance of 150 miles. The volume of these commodities hauled were: Boats, 840 lb.; yeast, 10,445 lb.

The shortest haul reported was that of charcoal, 2150 lb. of which were hauled an average distance of 3.50 miles. The next shortest haul was milk, 4725 lb. of which were hauled an average of 5.80 miles.

Agricultural products make up only 14.3 per cent of the traffic in the second census; manufactures and miscellaneous 72.5 per cent, indicating, according to the report that truck movement in Connecticut is predominantly that of manufactured goods of high value and small bulk.

Because the survey was limited to one season all agricultural products are not represented in the list of commodities. The average haul of agricultural commodities is 39.5 miles; the longest, eggs, is 68.21 miles.

Extending observed weights and hauls during the period of the second census it is estimated that the annual ton-mileage of agricultural commodities is 86,649.

Estimated value of agricultural products hauled both ways over Boston Post Road at Greenwich, based on observations of the second census, \$15,075,000.

Comparison of Truck and Railroad Traffic

Comparing the truck traffic observed in the second census with traffic over the New York, New Haven & Hartford and Boston & Maine Railroads, the results are as follows:

	By Truck	By N. Y., N. H. & H. (1918)	By Boston & Maine (1920)
Products of Agriculture ...	14.3	9.4	11.8
Product of Animals	11.2	3.3	3.2
Product of Mines	0.5	42.5	36.8
Product of Forests	1.5	6.5	13.2
Manufacturers and Miscellaneous	72.5	38.3	3.50

Total observed east-bound truck traffic, second census, 239,562 ton-miles.

Adjusted to give 24-hr. traffic for the 2-week period, 360,000 ton-miles, eastbound.

71 per cent of east-bound traffic loaded.

36 per cent of west-bound traffic loaded.

Estimated traffic both ways for 2-week period, 540,000 ton-miles.

Assuming this traffic to be average for year the annual east and west movement at Greenwich is estimated at 14,040,000 ton-miles of pay freight.

The average haul of truck movements was 47.44 miles.

A Census of the Petroleum Refineries in the United States

PETROLEUM refineries in the United States on January 1, 1922, numbered 479 completed plants, with 30 additional plants in process of construction, according to a statistical summary prepared by H. J. Lowe, petroleum economist of the Federal Bureau of Mines. The indicated daily refining capacity of these plants is 2,164,050 barrels of crude oil.

The tremendous increase in the extent of the petroleum refining industry of the country is shown by the fact that in 1914 but 176 petroleum refineries had been completed. Within eight years the number of refineries has been increased by 172 per cent.

Texas at present leads all other states in the volume of oil refining business, with 63 operating plants, with a daily capacity of 345,150 barrels; in addition, the state had on January 1, 46 refineries in shut-down condition, while 9 other plants were being built. Oklahoma is the second state in number of refineries, with 54 operating and 43 shut down; operating plants in this state had a daily capacity of 234,650 barrels. California, with 34 operating plants, was refining 314,360 barrels daily.

Pennsylvania had in operation 48 plants, with a daily refining capacity of 114,930 barrels. New Jersey, with but 5 refineries, treats 224,000 barrels of oil daily.

The importance recently attained by the state of Louisiana in this industry is indicated by the fact that 14 refineries were treating 114,350 barrels daily, while 11 plants were in shut-down condition. Kansas, with 19 operating plants, was refining 57,650 barrels daily; Illinois, with 12 plants, was handling 62,050 barrels; Wyoming, with 11 plants, was refining 89,900 barrels; and Indiana, with 5 plants operating, was handling 54,300 barrels daily.

Of the 479 completed refineries in the United States, 154 were in shut-down condition at the first of the year. The daily refining capacity of these non-operative plants was 254,610 barrels, or approximately one-eighth of the entire refining capacity of the country. The 30 new plants in process of construction will, it is estimated, add 59,950 barrels to the country's daily refining capacity.

Copies of the directory of petroleum refineries in the United States may be obtained from the Bureau of Mines, Washington, D. C.

Automotive Industry Organizes for International Trade

Foreign trade will absorb from 5 to 15 per cent of American automotive production. This may mean the difference between profit and loss. The trade associations have recognized the practical help that can be given by the Automotive Division of Bureau of Foreign and Domestic Commerce. This report presents information of vital importance to manufacturers.

AUTOMOTIVE transportation is an international institution. Automobiles, motor trucks, motorcycles, motor boats and aircraft provide the transportation so necessary to modern civilization.

The introduction of the internal combustion engine is fraught with more significance than any other recent development in the great territories of North and South America, Europe, Africa, Asia and the Pacific. Just as the steamboat, the locomotive and the telegraph were the vehicles that brought about the world upbuilding of the nineteenth century, following the devastation wrought by the long Napoleonic conflicts, so will the automobile, the airplane and the motor boat guide the twentieth century and speed up the economic development that must follow the World War.

To the automotive industry of America has fallen the leadership and the direction of this world wide need for transportation. The American industry alone is prepared to supply the essential passenger cars, motor trucks and attendant equipment. Its ability to build and produce these vehicles places upon it an obligation of education and service far transcending the continental limits of the United States.

America has a duty and an opportunity. It is her commercial destiny not merely to export American-made automotive vehicles and equipment but to bring to the entire world the benefits of efficient transportation on the road, in the water and through the air.

This report has been prepared by the international trade committees of the several associations having to do with the manufacture and distribution of the various automotive products. The purpose is to explain something of the assistance that may be accorded them in building up their international sales. The belief of the committees of these associations and the sub-committee preparing this report is that our industry cannot longer delay in taking its rightful place in this world movement. Other countries naturally will find it worth while to take advantage of the production facilities which have been so highly developed in this country during the last two decades.

Each company and each firm, no matter how large or small, should investigate the possibilities for the use and sale of its products in these other countries. Many companies, it may be found, have no place in this trade, as the character of their products, the volume or production or other conditions may not warrant more than a local merchandising effort. But to numerous others a definite volume of international sales seems assured if they will but make an honest and careful campaign to obtain it. To such firms, this report is directed.

The value of this trade is two-fold. The first is that

it will absorb a certain percentage of production—5, 10, 15, perhaps 20 or 30 per cent—in any event, the final proportion that may mean the difference between profit and loss. Secondly, it insures a definite volume of monthly production. Sales seasons differ throughout the world. When the curve of demand is falling in the northern countries the change in season swings the sales upward in territories south of the equator, thus assuring a more continuous production than is possible if only one territory is cultivated.

The question is not so much as to the value of international trade but as to how it may be obtained. Thus we come to the real purpose of this report, which is to explain the work and the activities of the Automotive Division of the Bureau of Foreign and Domestic Commerce, organized under the Bureau of Commerce to aid in the enlargement of the international sales of American-made automotive products.

The object of the Bureau is to collect and disseminate information on the various markets and to lend every hand in the promotion of commercial relations between this and other countries. Previously the Bureau consisted only of regional, technical and service divisions, but, in 1921, to these older divisions were added an additional twelve, each of which embraces a special commodity, such as agricultural implements, rubber (including tires), electrical equipment, fuel, foodstuffs, lumber, textiles, etc. Naturally, because of the great strides already made in the international field by the American automobile, one of the new divisions concerns itself with automotive products.

Under this division fall passenger cars, motor trucks, motorcycles, marine engines and motor boats, airplanes and aircraft, with, of course, the parts, units, accessories and service equipment that go with them. These products constitute the automotive industry and it is the development of their use for which the Automotive Division is working.

An outline of organization shows Herbert Hoover, as Secretary of Commerce, the head of the Department of Commerce. Under him is the Bureau of Foreign and Domestic Commerce, directed by Dr. Julius Klein, with the Automotive Division as one of its component parts. This division is directed by Gordon Lee with M. H. Hoepli as assistant chief.

The organic act which created the Bureau provides that its name shall embrace both foreign and domestic commerce, but that is almost a misnomer, at least so far as the present work of the Bureau and of the Automotive Division is concerned. Its activities are entirely directed to the promotion of foreign commerce, although this requires constant contact and work with manufac-

turers and distributors at home. Later, it is expected that some phases of the domestic trade will come under the bureau activities but, as now functioning, it is exclusively devoted to the upbuilding of overseas business.

The Bureau and the Automotive Division act solely in an advisory capacity, furnishing information upon which American manufacturers and distributors may obtain international outlets. To understand the extent of this information, a review of the established contacts throughout the world and at home is essential.

There are in other countries approximately 1000 official representatives of the American government, these being commercial attaches and trade commissioners in the larger centers, consuls and consular representatives. These representatives are co-operating wholeheartedly in the work of the Division. An automotive trade commissioner is now traveling in the Far East and another will leave shortly for Europe. Each of these thousand or more officials is transmitting up-to-the-minute and thoroughly reliable information back to this country for clearance to the industry through the various channels that are being provided. In addition to their reports, the Division is receiving a vast amount of material from unofficial sources, from business publications and daily newspapers published in other countries and from travelers and visitors who come in contact with the Division and its representatives, either at home or abroad.

These reports provide surveys of the trade, including past, present and potential developments. Statistical information is supplied regarding registration, importation, exportation, etc., and other reports, frequently by cablegram, are regularly received regarding current market conditions, significant developments and trade opportunities. The material is transmitted to the Automotive Division either automatically and at stated intervals or upon special occasion. When a tender is offered, for instance, for motor trucks in Brazil, Spain or Japan, or for motorized fire fighting equipment or airplanes in Bombay, Buenos Aires or Capetown, full information concerning it is sent to the Division, either by mail, or, if the time is short, by cable and is then supplied at once to manufacturers and distributors here. Dozens of such inquiries are being received each week from numerous countries covering all automotive products, ranging from aircraft to accessories and service equipment.

Questionnaires dealing with local registration dis-

tribution channels, dealer establishments and other similar topics have been or are being submitted to all overseas representatives. The registration questionnaire, as an example, provides for a careful and authoritative world census on passenger cars, motor trucks, motorcycles, airplanes and fire fighting equipment. Returns from it are being tabulated as they are received, district by district, the results being made public from time to time. This census will prove of immense value

to motor equipment manufacturers in laying out and planning their sales campaigns and it will enable them to picture the markets as they exist at present or may be expected to develop in the years to come.

Monthly reports are being received, by cable, from the important territories, these reports being both general and specific in nature. The Department representatives review the economic, agricultural, financial and industrial conditions in each territory, thus drawing a conclusive showing of the possibilities of that market for immediate or future business. A recent step forward is the enlargement of cable service so that each of the monthly cable reviews will give specific information on automotive conditions. It must be remembered that the automotive industry is in the forefront of American industries having international possibilities and this special reference in the cable reports was deemed essential as a merited recognition of its importance.

The world stands in great need of American automotive equipment. The passenger car and motor truck and other equipment that has negotiated the roads of Kansas, Missouri, Oklahoma, Iowa or Nebraska, is likewise the vehicle best suited to overcome similar conditions and to give the maximum of service in Mexico, Patagonia, South Africa, India and other countries. This committee believes that nowhere else are produced the automobiles, airplanes, motor boats and motorcycles, regard-

less of price class, quality, durability or finish, that comprise the American output and it likewise believes that these are the products that must fill the myriad transportation needs of practically every territory. The airplane was invented in America and the automobile, the motor truck and the motor boat were brought to their present high standard of efficiency and value through the development that has taken place in this country. Nowhere else has the conception been held that the automobile is a vehicle of transportation and nowhere else has it been so perfected. Consequently the American

This report outlines the opportunities available for American automotive manufacturers in international trade and shows how practical commercial assistance is being given by the Automotive Division of the Bureau of Foreign and Domestic Commerce, under the direction of Gordon Lee.

The report was prepared under the direction of the following representative committees:

National Automobile Chamber of Commerce:

J. Walter Drake (Hupp Motor Car Corp.), chairman, and George F. Bauer, secretary, Foreign Trade Committee, 366 Madison Avenue, New York City.

Motor and Accessory Manufacturers' Association:

W. O. Rutherford (B. F. Goodrich Co.), chairman, and M. Lincoln Schuster, secretary, Foreign Trade Committee, 33 West 42d Street, New York City.

Automotive Equipment Association:

S. D. Black (Black & Decker Mfg. Co.) and Graham W. Brogan (Black & Decker Mfg. Co.), Foreign Trade Committee, City Hall Square Building, Chicago.

Aeronautical Chamber of Commerce:

Luther K. Bell, 501 Fifth Avenue, New York City.

Motorcycle and Allied Trades Association:

W. G. McCann (Hendee Mfg. Co.), chairman, Foreign Trade Committee, Springfield, Mass.

National Association of Engine and Boat Manufacturers:

Ira Hand, secretary, 29 West 39th Street, New York City.

Association of Automotive Equipment Manufacturers:

Noah Van Cleef (Van Cleef Bros.), chairman Foreign Trade Committee, and W. E. Green, secretary, 3222 Washington Blvd., Chicago.

The Class Journal Co.:

George E. Quisenberry (El Automovil Americano), 239 West 39th Street, New York City.

automobile stands upon the threshold of a world use so large that its possibilities can be little more than imagined. As we have built up our home demand and as we have evolved its many uses—from the Atlantic to the Pacific and from the Great Lakes to the Rio Grande—so also is the remainder of the world looking for the simplified but meritorious automotive vehicle of American design to furnish the transportation needed in city, town and rural district.

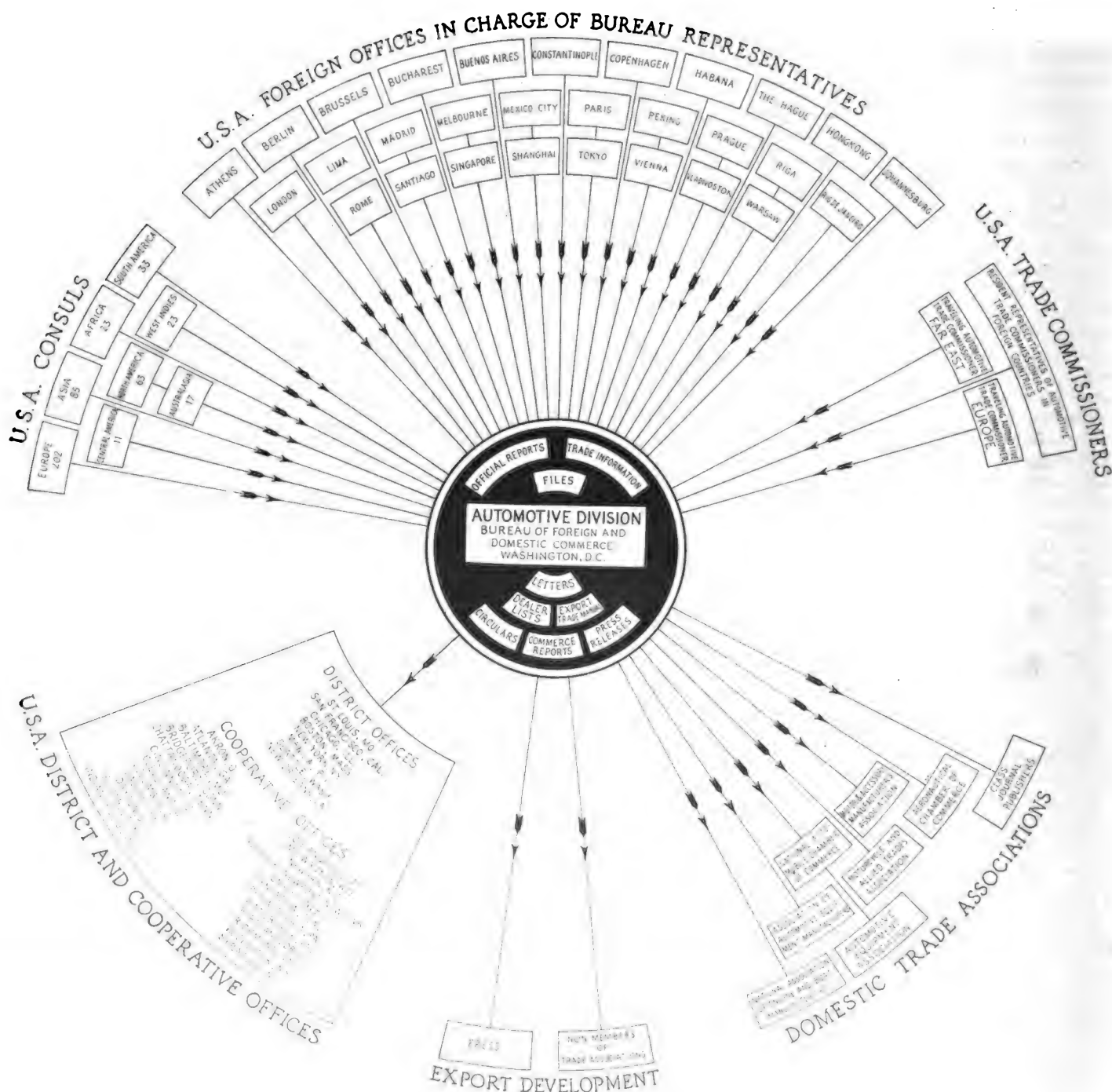
The Automotive Division is seeking to bring back the picture of these developing markets so that full advantage may be taken of the numerous opportunities for trade that are being offered. Let us go further into the manner in which the Division functions.

The information gathered from all overseas centers must be transmitted to the trade if it is to have any value. Some of the material is of no practical value and naturally is discarded. A part is not suited for publication but is valuable for reference purposes and is in-

corporated into permanent files. Some is confidential or semi-confidential and distribution must be guarded accordingly. Other material is released at once to the automotive business papers, the daily press or is published in other form. The large bulk of all the information finds immediate transmission to the trade.

The first contact of the Division with the industry is through "Commerce Reports," the weekly publication of the Bureau. It contains an automotive section, together with a resumé of conditions in the different centers and a list of trade opportunities or leads for immediate business. This committee recommends to all interested firms or individuals a subscription to this report.

A second contact is through the Exporters Index. To all firms properly listed on the index, confidential bulletins and lists of trade opportunities are sent from day to day as they are received. Only firms of undoubted American foundation and standing are placed in the index by the Department of Commerce. This committee



recommends that all companies avail themselves of this opportunity. Information concerning it and the proper blank forms for listing may be obtained either from the committees of the various associations or direct from the Division.

Lists of overseas dealers also are in process of formation and will be supplied upon request. Lists of this nature previously furnished have given little information upon which a manufacturer or exporter might base a sales campaign, but this fault is being corrected and those now coming from the Division contain many more facts than formerly was the case.

Reference files of the Division are also open to the trade. Of primary importance are those under such general subjects as:

Aircraft	Sales Promotion
Automotive Transportation	Miscellaneous
Statistics	Parts and Accessories
Markets	Automobiles
Service	Motor Trucks
Legislation	Customs
Motor Boats	Contingent Factors
Transportation Possibilities	Distribution
Production	Preferential Specifications

These files are subject to indefinite expansion and are so flexible as to permit the establishment of numerous sub-headings. Key indices are kept so that reference to all subjects is readily possible and the Division is building up a library containing automotive reference books and business journals. Furthermore, the Division is preparing special reports upon each territory, with distribution points outlined, potential demand, customs, preferences, tariffs, etc. Many of these reports, some specifically considering road and highway construction, have been brought out and others are in the hands of printer or are nearing completion.

Tariff laws and special regulations of each country are being studied for their import to the industry and special bulletins upon these subjects are promised within a short time. This committee believes that American manufacturers, distributors and exporters will find the files, libraries and reports of utmost importance in regard to whatever international campaigns may be under way.

The Division, if its full value is to be returned to the industry and if the industry is to profit from it according to the full opportunities presented, must be considered as being other than an academic institution. That it is not academic will be borne out amply by any contact and regardless of any preconceived notions that may be held because of its location at Washington and its organization under a government department. This committee believes in the work of the Division only after a full investigation and because of what it already has completed or has instituted.

Gordon Lee, the chief, came to the division from the industry itself, his appointment having been largely at the direction of the National Automobile Chamber of Commerce. Lee has been associated with the industry for years and was a member of the family of George B. Selden, the inventor of the automobile. Aside from extensive domestic experience in the manufacture, distribution and sale of motor cars, trucks and motor tractors, he has traveled extensively abroad as an automotive representative. Since his appointment in 1921, Lee has made various trips to the automotive centers and is thus keeping in close touch with developments in the domestic field, this naturally being necessary for a proper survey of the international markets.

Much of the organization work of the division has

been in the hands of M. H. Hoepli, assistant chief of the Division. Previous to his present work, Hoepli was executive research assistant for one of the largest American automotive corporations. In addition, he has had first hand experience abroad.

Much of the information collected by the Division will be distributed to the various manufacturers through the associations of which they are members and by the automotive business papers. These contacts have already been formed by the Division through the associations previously listed.

International trade bulletins already are being sent out to all members by the National Automobile Chamber of Commerce, the Motor and Accessory Manufacturers' Association and the Aeronautical Chamber of Commerce. Arrangements for similar bulletin service are being considered by the Automotive Equipment Association, the Motorcycle and Allied Trades Association and the National Association of Engine and Boat Manufacturers.

Thus it will be seen that the American industry is advantageously situated to take its proper place in the international automotive development. This committee believes that the Automotive Division of the Bureau of Foreign and Domestic Commerce will prove of immense help in aiding and guiding the industry in matters pertaining to international sales. Subjects of practical importance at the time of writing include the following:

The fostering of wider and cheaper distribution of gasoline and kerosene.

The use of alcohol as a motor fuel in those territories where it may be produced economically.

The upbuilding of service and distribution facilities. The promotion of local automobile shows and expositions.

The furtherance of good roads and highway improvement.

The development of motor bus, passenger and freight carrying lines.

The establishment of commercial aviation projects.

The extension of motor boat use.

To these may be added the production and exhibition of motion picture films explanatory of the American automotive idea, the packing of international shipments, the organization of automotive dealer associations in the various foreign centers and the participation by manufacturers and distributors in merchandising, servicing and financing all automotive products.

The committee believes that the international markets offer wide possibilities for the many American firms which will intelligently and honestly seek its development. The committee believes likewise that the best ideals and the highest integrity of American business should be maintained and safeguarded at all times in this international commerce.

The world's needs for transportation have been little more than touched and the coming months and years are so fraught with promise that this committee hopes every real American firm will investigate without delay and determine what position it should occupy in this great business.

ACCORDING to German patent No. 810,261, to the Badische Anilin and Sodafabrik, rust can be removed from iron parts by treating them first with a dilute acid solution and at the same time or later on with a mixture made up of an emulsion of oil or grease, as, for example, 80 parts of water, 20 parts of hydrochloric acid of 20 deg. Baume and 25 parts of a 10 per cent mineral oil emulsion. The iron parts remain in the bath until the rust disappears and they are then rinsed and dried.

Practical Progress in S. A. E. Fuel Research Program

Fuel research is being carried out in four parts. Tests are under way at Bureau of Standards, and at a number of automobile plants. Purpose is to determine what sort of fuels, as regards volatility, will give the average operator most transportation miles per barrel of crude oil used.

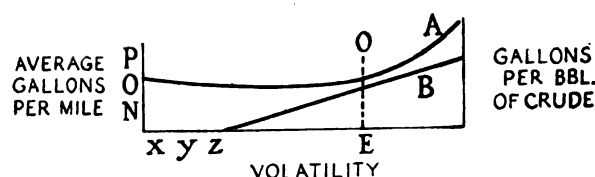
THE automotive industry recognized some time ago the necessity for a careful study of the fuel problem. Viewed from the standpoint of the automotive executive the fuel question may properly be stated as follows:

"What sort of fuels, as regards volatility, will give the average operator the most miles of transportation per barrel of crude oil used in the production of this fuel?" Or, in more technical terms, "What are the relations between fuel volatility, fuel consumption of the average vehicle, and fuel produced per barrel of average crude?"

We know that increasing end-point increases the available number of gallons of motor fuel, supposedly decreasing the cost per gallon, and that it qualitatively increases the average consumption, thus tending to increase the total cost of fuel. Neglecting for the moment other ill effects, it is obvious that there is here involved a broad question of economic balance. When adding heavy ends increases the number of gallons consumed more than the cost per gallon, we lose.

We may expect both industries to be best served when the motor gasoline produced from a barrel of crude de-

To put the question in such a form that it will indicate the technical answer we require, we may consider two curves:



Curve A has some such form as is shown. Fuel consumption goes up at an increasing rate as volatility goes down. But we know nothing as yet about numerical values of the co-ordinates. Curve B should be more easily determined. Refining figures can show how much motor fuel of any given volatility can be produced from an average barrel of crude by any selected process. An answer to the above question requires both of the curves A and B plotted together. This shows that there will be some point, O, beyond which the increase in consumption exceeds the increase in production. At about this point the total cost of fuel will increase.

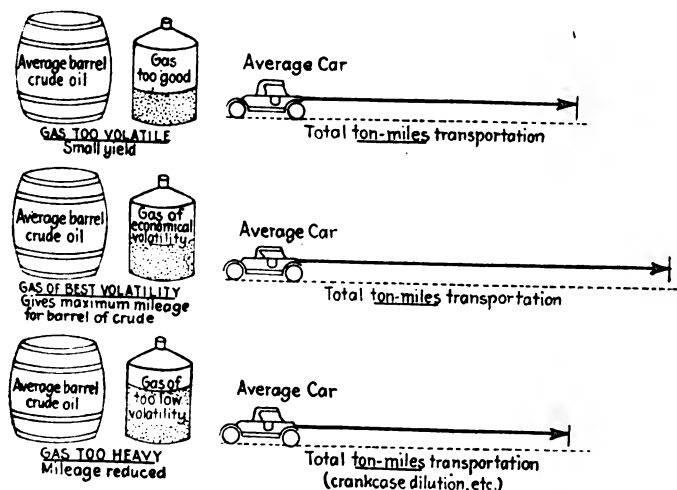
A systematic research program to accomplish the desired result has now been started, under the supervision of the Research Department of the Society of Automotive Engineers, which department will compile the results of the tests as well. This research program may best be described briefly in four parts:

1. Preparation of fuels.

Several of the refineries have made up batches of experimental motor fuels, the volatility of which has been decided upon after careful consideration. Four fuels are to be used, ranging in volatility from aviation gasoline to the heaviest which can be used in practical service. The U. S. Bureau of Mines is in charge of the specifications for these fuels and will make tests as to their quality, as well as control tests on fuel samples to be submitted by the various companies running the tests.

2. Road-laboratory tests of vehicles.

The United States Bureau of Standards has prepared a program of road tests to be made on each of the half dozen models of passenger cars representing the largest production. For the purpose of these tests, a most complete layout of indicating and recording instruments has been specially designed and built at the bureau by means of which accurate records of fuel consumption and all elements of car performance can be made under all conditions of normal road service. Thus the effect of the experimental fuels on both car mileage and car performance will be accurately known.



Maximum ton-mileage depends upon the correct fuel volatility. Therefore we must find what this correct volatility is.

livers the most mileage to the average vehicle. The accompanying drawing illustrates this point.

A barrel of crude oil will produce more or less gasoline, depending upon its volatility. If the volatility is correctly chosen, the total ton-miles of transportation per barrel of crude will be a maximum. If unnecessarily volatile, the amount of fuel will be small and the mileage less. If too poor, while the quantity of fuel will be larger, the miles per gallon will be less and the total ton-miles will be again less than the maximum.

3. Service road tests of vehicles by manufacturers.

A number of makers of the cars representing the largest production are each to put through a road test program with a number of their own cars in the hands of average drivers and in average service, to supplement the above part of the program by securing average results with a large number of cars under average service conditions. The companies making these tests include Studebaker, Packard, Dodge, Chevrolet, Stromberg and International Harvester.

4. Road tests by United States Government.

A very extensive series of road tests is also being run

by the Bureau of Standards, making use of fleets of Government-owned vehicles in Philadelphia and Pittsburgh. This program will require the use of about 80,000 gallons of fuel in several hundred vehicles. The three cities were selected because of their diverse road conditions, Pittsburgh being very hilly and Philadelphia almost level.

When these tests are completed, the research department of the Society of Automotive Engineers should be in a position to supply information which will make possible better economic use of the petroleum resources and longer postponement of the time when costs of fuel will retard the development of automotive transportation.

Gasoline Powered Industrial Lift Truck

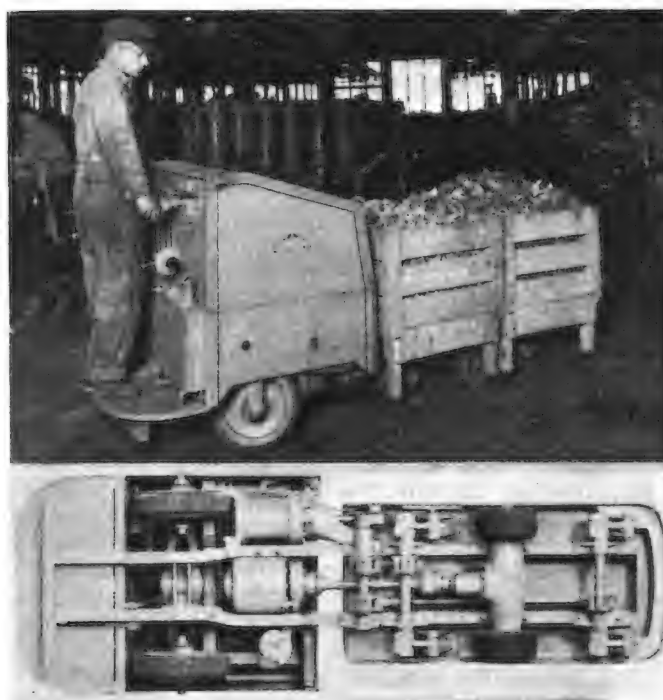
A GASOLINE powered elevating platform truck to be known as the Clark Truklift has been put in production by the Clark Tractor Co. It conforms in appearance and uses to the electric elevating lift trucks which have been used in industrial plants for several years. Low initial cost, ease of maintenance, flexibility and continuous service are characteristics claimed for it by the builders.

The loading platform measures 26 x 54 in. and will elevate its load of 4000 lb. from a minimum of 11 to a maximum of 16 in. above the floor in eight seconds. There are automatic stops for both the up and down limits, and elevation can be stopped by the hand control lever at any point. The lifting mechanism is operated by hydraulic pressure. Power for locomotion and elevating the load is derived from a 15-hp., 4-cylinder, $3\frac{1}{8}$ x $4\frac{1}{2}$ in. tractor engine which is mounted at the rear in a closed compartment containing the transmission, the governor, the vacuum tank and the radiator.

A three-point suspension is used, the steering wheel forks being supported in a steel casting which is pivoted at the center of the frame on a chrome nickel steel pin 2 in. in diameter. The drive is through a Clark bevel gear axle fitted with ball and roller bearings. Driving wheels are cast steel with pressed-on $10\frac{1}{2}$ x 5 in. rubber tires, whereas the steering wheels are of the cast-steel disk type with pressed-on 16 x $3\frac{1}{2}$ -in. rubber tires.

The driving and elevating controls are mounted on the rear of the engine compartment and are operated by the driver who drives standing. The brake pedal is under the driver's foot and so arranged that the Truklift stops automatically if for any reason the operator steps off while the machine is running.

The total weight of the Truklift ready for work is 2500 lb.; its over-all length is 107 in., the width $35\frac{1}{2}$ in. and the height 51 in. The machine has two speeds in each direction and is claimed to be able to climb a 10 per cent grade with a 4000 lb. load.



Clark Truklift in operation and view from underneath

RECENT experiments with gasoline-driven cars and comparative costs of operation of this form of equipment and steam trains hold out the hope that passenger service now conducted at a loss on about 50,000 miles of American railroads may be turned to a profit. Including 25,000 miles of short lines and 25,000 miles of branch lines of Class 1 roads, to both of which this sort of equipment is especially adapted, about 19 per cent of the country's mileage lends itself to the change.

The first thing the motor car does is to reduce the number of the crew by half. As the wages of engineers and motormen are influenced in part by "weight on drivers," the actual pay is reduced by more than half, the motormen falling under the minimum classification.

Pittsburgh & Shawmut has two motor cars in operation—one out of Brookville on a 98-mile run and one out of Kittanning on an 83-mile run. The wages of the crew on

these runs are respectively $17\frac{1}{2}$ cents and $22\frac{1}{2}$ cents a train-mile. The cars average 6.8 miles a gallon of gasoline.

According to Dwight C. Morgan, vice president, in a statement to "Railway Age," total cost of operation, including wages, materials and supplies, fuel and 4 per cent depreciation, amounts to 35 cents a mile. The cost of operation of light steam equipment, based on the same method of ascertaining costs, is 71 cents a mile, or more than double.

THE Engineering Advertisers' Association of Chicago is now publishing a monthly bulletin in the interest of its members. The Bulletin gives a digest of the speeches made at the various meetings and also includes other information and facts regarding the movement of goods from industry to industry, personal notes, etc.

Two S. A. E. Sections Join in Discussion of Chassis Losses

Metropolitan and New England Section members attend joint meeting at Mason Laboratory, Yale University, to inspect chassis testing equipment and participate in discussion of paper by Prof. Lockwood outlining an investigation of the frictional losses in tires and other parts of the chassis.

NEW HAVEN, April 22.

MEMBERS of the Metropolitan and New England Sections of the Society of Automotive Engineers held a joint meeting here to-day for the purpose of hearing and discussing a paper on frictional losses in automobile chassis, by Prof. E. H. Lockwood of Sheffield Scientific School, Yale University, and of inspecting the chassis testing equipment in the Mason Laboratory. The meeting was one of the most interesting and instructive ever held by either of the two sections, and was well attended.

Most of the members of the Metropolitan Section journeyed from New York to New Haven in two rail cars built for the N. Y., N. H. & H. Railroad by Mack Trucks, Inc., which were especially provided for the purpose, but others who could not be accommodated on the rail cars made the trip in buses furnished by Mack Trucks, Inc. This is believed to be the first time rail cars driven by gasoline engines have made a trip out of New York, and is certainly the first opportunity afforded any large group of engineers to make a long trip in vehicles of this description. The distance, 74 miles, was covered in 2 hr. 45 min., including stops, or at an average speed of 27 m.p.h. The buses, traveling by road a distance of 84 miles, made the trip in 3 hr. 22 min. elapsed time, or at an average speed of 25 m.p.h. Members of the New England Section met the rail cars here and were given an opportunity to make short trips in them prior to the meeting.

After a trip through a portion of the Yale campus, including in particular an inspection of the new Harkness Memorial buildings, and luncheon in the University Dining Hall, the section members were given an opportunity to examine the automobile testing equipment in the Mason Laboratory, after which a test run was made on a car to illustrate the methods followed in routine work of this character. Professor Lockwood explained in some detail the working of the apparatus and the methods followed in its use.

The engineers then assembled in the laboratory lecture hall, in which the joint meeting was held. Chairman Slauson of the Metropolitan Section presided. A brief business session followed, at which a report on the canvass of the mail ballot for Metropolitan Section officers was read. The following officers were elected: Chairman, W. E. Kemp; vice-chairman, H. W. Slauson; treasurer, W. P. Kennedy; secretary, R. E. Plimpton; members of governing board, C. B. Veal, Arthur Waterman and Joseph Bijur.

Dean Breckenridge of the Sheffield Scientific School made a brief address of welcome to the visiting engineers, and complimented Professor Lockwood upon the thoroughness and interest taken in the experimental work done under his direction.

W. L. Bean, mechanical assistant to the president of

the New Haven Railroad, asked to make a few remarks regarding the rail car, stated that he believes it has a future in helping to make branch lines which are not now profitable show a profit, or at least operate with less loss than heretofore. He believes that only a start has been made in this direction and that considerable development work will be required before a wholly satisfactory rail car is developed, but has great hopes for success in this direction. With a sufficient equipment of satisfactory rail cars he believes that the New Haven road can show a saving of about \$500,000 annually on branch lines now operated at a loss.

Professor Lockwood then presented his paper, portions of which will probably be printed later in these columns. He first described briefly the apparatus used, this apparatus being the same as that fully described in *AUTOMOTIVE INDUSTRIES* last week. The methods used are similar to those employed in power tests of cars on the rear wheel dynamometer, many of the results reported having been obtained in routine tests of cars, several of which tests were reported in the article in these columns last week. Professor Lockwood stated that it had been found possible to separate bearing and some other friction losses from tire losses by allowing the tires to rest very lightly on the driving drums and by driving them through the drums in this manner to measure approximately the bearing loss only, since, when the tire is not deformed by passing between rim and drum, the loss in the tire is practically nil.

By driving the front wheels and the rear wheels, including axle parts, propeller shaft and main shaft of gearset, with gears in neutral and measuring the tractive force required, it has been found that, for fifty passenger cars tested from 1916 to 1921, the weight varying from 2000 to 5000 lb., the rolling resistance, R , is given by the following equation:

$$R = 30 + 0.012 L$$

where L is the weight of the vehicle in pounds.

In the case of seven 1922 passenger cars in good condition, equipped with cord tires, it has been found that

$$R = 0.019 L$$

while for four heavy trucks, three of which are of 7½-ton capacity, equipped with solid rubber tires,

$$R = (30 + 70) + 0.018 L$$

Professor Lockwood believes that the well designed and constructed car of the future will have a rolling friction of about 0.016 L .

The rolling friction of the four tires (only) of various vehicles has been found to be about as follows:

Cord tires, 0.012 L — 2.

Fabric tires, 0.018 L — 3.

Solid rubber tires, 0.016 L .

It will be noted from these figures that fabric tires offer about 50 per cent more rolling resistance than the cord

type, while solid rubber tires offer about the same rolling resistance as well inflated fabric tires.

The frictional resistance of the bearings in the front and rear axles, gears and other parts driven when the rear wheels are turned with the gears in neutral (all running idle) has been found to be about 0.06 *L*. The average frictional loss in the following cars—Overland, Mercer, Buick, Franklin, Haynes, Oldsmobile and Cadillac—was found to be divided about as follows:

	Per Cent
Total tire friction.....	66
Bearings, axle parts driven from it (running light) .	34

Speed has been found to have but little effect upon the rolling resistance of either tires or bearings, but of course the power loss increases in substantially direct proportion to the speed. Thick wall inner tubes add slightly, 5 to 10 per cent, to the total rolling friction of tires, and a rough tread adds about the same amount of frictional resistance, over the smooth tread, as does the thick wall tube, this applying, of course, to tires which are similar in all respects except as to the character of tread.

Partly worn pneumatic tires have been found to have about the same rolling resistance as when new, but partly worn solid tires have less resistance than new ones.

All sizes of pneumatic tires, Professor Lockwood said, have, in proportion to their carrying capacity, substantially the same rolling resistance, providing each size is inflated to the pressure recommended by the maker. Rolling resistance decreases with increase in inflation pressure, but the difference is more marked at the lower pressures. At high inflation pressures a given increase in pressure decreases the rolling friction more in the fabric than in the cord type of tire.

It was pointed out that the rolling resistance of a vehicle is often materially affected by changes in the temperature and consequently the viscosity of the lubricant.

Discussion

In the discussion which followed presentation of the paper, Major Ireland of the Motor Transport Division, Quartermaster Corps, U. S. A., stated that Professor Lockwood has been co-operating in the work which he, Major Ireland, has been doing on behalf of the National Research Council in studying the various factors relating to the rolling resistance of vehicles under various conditions. The results of this work, which includes in particular an effort to determine the effect of the character of road surface upon rolling resistance, are to be published as rapidly as possible.

Herbert Chase stated that he had been given an oppor-

tunity recently to study the methods followed and results obtained in vehicle tests made by Professor Lockwood and to criticize these in the light of past experience along similar lines. He commended the work already done, which he said should prove of great value to the industry as well as to individual engineers, but suggested that better methods of determining wind resistance be developed and that steps might well be taken to determine whether or not there is, as seems likely, a greater loss in tires and other power transmitting parts when these are driven under load instead of when running light, as in tests conducted by Professor Lockwood to date. Chase suggested that windage might be measured by driving the car on a level road at various speeds, noting the manifold depression and air speed (to determine the effect of head or tail winds) and that the car then be brought to the laboratory and the test repeated at the same speeds and manifold depressions, the power delivered at the rear wheels and that absorbed by the front wheels being measured. The difference between the last two quantities would then be a measure of the power lost in overcoming wind resistance. Suggestions for measuring the power lost in gears and tires under driving loads were also made, and the importance of developing engines which are efficient under the light loads of normal average running was pointed out.

In answer to a question by C. F. Scott regarding the effect of drum curvature upon tire losses, Professor Lockwood said that he had no data upon which to base a reply. He said in regard to a similar question regarding the effect of tire diameter on tire losses that he would expect the difference in power consumed for a given cross section and weight to be very small, if any existed.

Answering a question as to the reason for abandoning a device for direct measurement of drawbar pull which was formerly used, Professor Lockwood said that the resistance of the front tires to the forward motion of the car introduced a factor which seriously affected the results obtained, consequently the weighing through prony brake torque measurements had been substituted.

C. T. Myers suggested the use of an accelerometer for measurements of windage. This instrument can be used for the purpose when the amount of other resistance factors determined in the laboratory are known.

Others who entered into the discussion drew attention to the losses in springs, and the increased losses in tires which result from an irregular road surface. While the existence of such additional losses are recognized, Professor Lockwood said, he has not given consideration to their measurement.

Aluminum Investigations of U. S. Bureau of Mines

A STUDY is now being conducted by the Bureau of Mines of the causes of, and methods for the prevention of, cracks in light aluminum-alloy castings. The investigation as planned includes also the determination of the contraction in volume and of the linear contraction of a series of commercial aluminum alloys, as well as an examination of the cracking tendency of the alloys when poured into different kinds of molds. This study is being made in co-operation with the General Motors Research Corporation and a number of automotive and other foundries. The investigation is part of a general study of defects in aluminum-alloy sand castings. Data have been gathered from a number of foundries as to the causes for cracks and the best methods of prevention. A number of measurements have been made in the laboratory on the contraction in volume and piping effect of

aluminum alloys and also on their linear contraction in graphite molds. The problem is in course of investigation.

ROBERT J. ANDERSON, metallurgist of the Bureau of Mines, Pittsburgh, Pa., is examining methods suggested for the deoxidation of aluminum and its light alloys. The presence of aluminum oxide in the metal or in its alloys seems to lead to defects of various kinds, and the problem is under consideration for study with a view to obtaining, if possible, a commercial deoxidizer. Preliminary experiments have been made with the use of misch metal (ferrocium), and with boron suboxide for the deoxidation of aluminum-copper alloys. The former material appears to possess some possibilities, and further experiments are to be made.

Dealer Mortality in Automotive Field Not Exceptionally Large

Considering the rapidity of development in the automotive industry, dealer mortality is not high as compared with that of older industries. Greater stability is necessary, however, to reduce selling costs. Departmentalized establishments growing more rapidly than specialized shops.

By Harry Tipper

THE term "automotive dealer" is not thoroughly expressive of the automotive retail establishment and the work which must be done in this field, because the term is too strictly limited to an understanding of selling. In an earlier article we pointed out that the automotive business had revolutionized the work of manufacturing development in several ways because it is the first time in the history of the industry that a complicated machine has been sold in enormous numbers and used by amateurs. The whole retail field in the automotive industry is concerned with the sale and maintenance of a unit system of transportation under the control of the individual and available for his purposes with great flexibility and convenience. Consequently, the sale of the merchandise, whether it be car or truck, parts accessories or supplies, is not the end of the transaction, but the beginning of the contact.

The value of the particular article is subject to the use of the transportation system and the big job of the industry is to make the transportation system more efficient and to keep it in shape.

In the ordinary lines of retailing the service which has been added is a very subsidiary part of the proposition and the main function of the retailer is to provide a reasonable selection of commodities in a convenient store; see that the customers know about the commodities in this store; and sell and deliver the articles to them. In 90 per cent of the cases this closes the transaction and any further service is of minor importance. In the automotive field, on the other hand, value of the retailer in the sale of the goods is measured by his usefulness in keeping the car or truck running or in adding to the efficiency, convenience, or comfort of using the transportation itself. From the complete car and truck to the small accessory, every article sold in this business is measured by its value in the work of transporting passengers or freight in the most convenient, comfortable and flexible fashion.

This business in its growth was faced with opportunity so large and diversified that the big problem was to speed up the production and distribution so that the waiting public could be satisfied at the earliest date in their demands for this species of transportation. The business grew with great rapidity, revolutionizing methods and seizing upon possibilities to accelerate the speed of its own growth so that the customer could be provided with this convenience of transportation as fast as possible. With this rapidity of growth, a great many differences occurred in this field in a larger measure than they occurred in the older fields where there has been an opportunity to settle down considerably further

and where the systems have been more firmly solidified.

The number of retail establishments has grown with great speed and as a consequence of this growth the number of people coming into the business of retailing in the automotive field has been very large and the mortality has been considerable. For many reasons the automotive retail field was an attractive one to the man who desired to be working independently. It was not governed by tradition. It was not slowed up by being solidified into the system. It was experimental, dynamic and offered large opportunities for the restless man who found the ordinary course of business too slow or too monotonous for him.

The men who entered this retail field came from all lines of business with all sorts of training. They entered a business with new problems, and no set methods of doing anything, so that they were obliged to experiment and find out the best way of dealing with their own difficulties. If any business man had been told that the retail distribution could be established within 15 or 20 years and grow from a small experimental possibility to the third largest industry, the thing would have been counted impossible. What has been done in this field is remarkable. It should not be remarkable that there are many differences in the retail establishments, many different tendencies running parallel to each other among which a manufacturer may be misled unless the strength of these various tendencies and their directional movement is thoroughly understood.

There is a general impression that people who go into their own business represent largely the more efficient individuals. This is not altogether so. There are many men who are restless and dissatisfied with the ordinary conditions of their employment, who will find an opportunity to escape from these conditions by entering a retail field where the capable requirements are not large and there is apparent necessity for more workers. In the years from 1910 to 1920, the automotive field offered a great visible opportunity to many of these men. Mechanics, salesmen, restless men from other lines of business, men from other retail lines—all flocked into the business of retailing, either the sales or the service required to perfect this unit system of transportation.

These conditions have brought the retailing of automotive apparatus and service to the point where the problem begins to show itself and the retail establishments must define themselves into a more orderly system in order to meet the future requirements. In other words, the work done by the retail establishments in the automotive field in the rapid growth up to 1921 has not been at the maximum requirements or concerned with

the maximum problems of the field. During such a rapid growth, many elements became involved in the field and many tendencies visible that are simply elements of growth and may pass out when the field defines itself more clearly.

The depreciation in 1921, coming as it did, after a period of unparalleled growth, has caused the manufacturer, the jobber, and the retailer to question and to analyze. This questioning analysis is resulting in the experimental development of many new alignments or realignments in the endeavor to secure a more efficient distribution or a more concentrated service value. These new alignments are not always developed along sound economic lines and some of them may only add to the confusion in the field instead of defining and simplifying. The present conditions to be observed are these:

1. The number of retail establishments in the automotive field is very small in proportion to other lines of business for the amount of money and effort involved, and it is probable that the number of retail establishments should be considerably larger in order to do all the work required for the maximum service of this unit system of transportation.

2. There are two apparently divergent tendencies to be observed in retailing:

- (a) The tendency to operate specialized shops

- (b) The tendency to operate departmentalized establishments

These tendencies need to be carefully weighed and considered in order that their significance may be understood. There are stores devoted entirely to supplies, accessories, etc.—sales establishments entirely. There are retail establishments devoted entirely to radiator repairs, machine repairs, electrical service, etc. There are also many retail establishments carrying an accessory department, a repair department, space for storage, and the other necessary elements for the work of keeping the automobile and the truck running.

A general examination of the situation shows that the departmentalized establishments are growing more rapidly than the specialized establishments, and they represent a very much greater proportion of the worth-while retail developments. This is a logical tendency because the bulk of the automotive transportation equipment is owned in the smaller towns and cities—where the departmentalized establishment possesses only sound and large possibilities of growth in development. The logi-

cal sound development of the business in all except a few large cities of the United States is along the lines of well organized, departmentalized retail establishments capable of providing the car owner with his new cars, his service, his supplies, his repairs and maintaining complete contact with the individual customer.

One of the elements of greatest importance in the retail field has been the mortality among retail establishments and therefore the greatest difficulty in the manufacturer's maintenance of the proper distributing outlets, both in character and in number. There is a good deal of misconception concerning this mortality. Many of the manufacturers in the automotive field appear to be under the impression that the mortality in this field is entirely out of line with the other retailing fields.

The mortality in the automotive field is higher than it is in the older retailing fields. It should be considerably higher on account of the rapidity of its growth and the very few years of its existence. It is not very much higher, however, and the indications are that in proportion to its age, it possesses as much stability as the older fields of retailing. In the investigations conducted just before the war the average percentage of grocery and hardware stores operating on insufficient capital reached between 30 and 35 per cent, and in the large cities the mortality in

this type of store was very considerable. It is estimated that approximately 40 per cent of the retail establishments in the automotive field are insufficiently capitalized, have no credit, and are therefore of doubtful stability, while the actual mortality in the field is estimated at about 33 per cent.

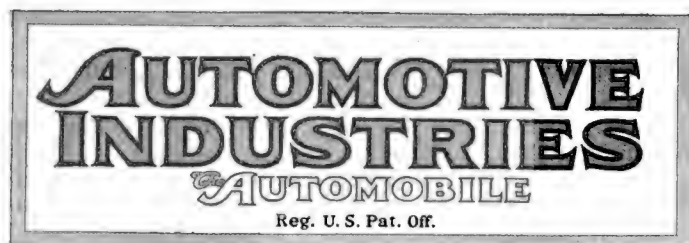
While this mortality is not startling, it is a very important question to the manufacturer because it means that upward of 20,000 dealers went out of business in 1921 and as many, or more, came in. All manufacturers are interested in limiting the losses involved in this development and maintaining themselves in the retail field in accordance with the increasingly efficient and stable elements. The field of retail establishments should be analyzed, not only as to present conditions and stability, but also as to the probable future developments, so that the contact of distribution can be maintained without feeling the full effects of the mortality nor the various difficulties involved in the experimental tendencies to be observed in the automotive industry.

Room for More Cars in Peru

THE Peruvian market for automobiles has, in the past, been largely confined to Lima, the capital, and one or two other fairly large cities. This has been largely due, it was brought out in a recent issue of Commerce Reports, to the fact that highways connecting most interior points are in poor condition. This condition bids fair to be overcome, however, as the government is planning to build a series of roads in the interior connecting the more important places. Such a move should go a considerable distance toward increasing the potential car market in that country.

The best season for the sale of cars in Peru seems to

be during June and July, just before the celebration of the national fiestas. Money is more plentiful from August to October, when the cotton crop is marketed. Several obstacles are to be overcome in selling cars, chief among which is the high cost of upkeep. Gasoline is expensive, and service stations, especially in outlying districts, are rare things. Nevertheless, American cars have obtained a firm foothold and there is little to fear from foreign competition. The pioneer period of the automobile has passed, but as the interior sections are developed so will the sale of automobiles and equipment develop.



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Automotive Industries—The Automobile is a consolidation of The Automobile (monthly) and the Motor Review (weekly), May, 1902, Dealer and Repairman (monthly), October, 1903, and the Automobile Magazine (monthly) July, 1907.

Automotive Engineers and Highway Development

PROPERLY constructed and properly laid out roads are essential to automotive progress. In the past the roads have been built almost entirely without the advice or assistance of the automotive engineers who are responsible for the vehicles which must run over the highways. The civil engineers who have borne the entire burden of road development have not always had in mind sufficiently the needs of the automotive vehicle for which the roads were being built.

The automotive engineer has a definite and constructive part to play in road development. His assistance is needed in solving such problems as the following:

1. Relation of the vehicle to the road. The factors in vehicle design, such as weight distribution, springing, tire equipment, can be properly treated only through the efforts and co-operation of the automotive engineer.

2. The cost of vehicle operation, including fuel, service, upkeep, etc., is important in its relation to the cost of highway construction and maintenance.
3. Highway safety and education. Insofar as safety to the public depends upon vehicle design, condition and efficiency of brakes, ease of control, etc., the subject is one to be considered by the automotive engineer responsible for design.

A number of research problems are involved in these subjects, which demand the attention and consideration of the automotive engineer. It is time for the designer of the vehicle to play a more important part in determining methods and policies in developing the roads over which his vehicles are to travel.

The Industry Watches Its Step

STOCK chasers are on the road again for motor vehicle manufacturers trying to speed up deliveries of supplies. Large quantities of the smaller units and accessories used in passenger cars are being shipped by express.

Thus, in some respects, the industry has reverted to the conditions which prevailed at the peak of production in 1919 and early 1920. Production in the passenger car plants which build the more popular lines is rapidly approaching capacity when it has not already reached that point. As a consequence desperate efforts are being made to speed the delivery of supplies.

There are important differences, however, between the conditions now and those when the industry was at the zenith of its output. They are:

Manufacturers are not bidding against each other to get much needed material.

Manufacturers have learned their lesson and they are determined not to tie up their working capital in inventories which will be unwieldy if there is a slump in sales.

When all supplies are purchased on a hand-to-mouth basis there is little danger of inventories getting out of balance.

The larger builders are piling up no reserves of completed vehicles.

Parts makers are steaming ahead. Many of the companies which supply the larger passenger car builders, have reached capacity production and a few are working night shifts. Almost every manufacturer in that field has about all the business he can handle. They are in the same position as the vehicle makers, however, for they don't propose to build up big inventories when the commitments given them do not run more than sixty days ahead at most.

The improvement in business in the past two months has been astounding. Production is approaching its peak load, but the industry as a whole is moving cautiously and it is prepared to shorten sail at the first sign of a squall.

Even the most optimistic do not expect production can go on indefinitely at the present rate. They can see no slump ahead for at least sixty days, but they believe there is little doubt there will be a seasonal falling off in sales with the coming of July.

It probably would have been better for the industry if prosperity had not returned so rapidly and so suddenly. It is running too far ahead of the industrial fabric as a whole, although the country as a whole has made amazing progress since the close of January. It will, perhaps, be just as well if there is a slowing up in the third quarter to give a breathing spell and let the rest of the country catch up.

No matter what happens, it is certain that 1922 will be a better year than 1921, which wasn't so bad. If there is a slump in the third quarter, whatever is lost undoubtedly will be recovered in the last three months of the year.

With the Minnesota branch of a truck company selling more light delivery vehicles in the first fourteen weeks of the year than any other branch in the country, there is no doubt of what the farm market for motor vehicles will be by the close of the year.

Financing Foreign Shipments

AUTOMOTIVE export trade has definitely turned the corner and is well on the upgrade. This fact is shown by every recent study of statistics and conditions. There are many problems before the American automotive exporter, however, which must be properly solved if our export trade is to be built upon the firm foundation that is desirable.

American firms in the past have borne very little of the burden of financing in their foreign business. Usually cash in New York has been demanded and obtained before the shipment was sent. Other nations exporting automotive products have usually extended more liberal terms to the foreign buyer.

This phase of exporting is particularly important at the present time. A representative of an important automobile exporter, after interviewing bankers and export houses in New York recently, voiced the opinion that it would be necessary for American automobile firms to take some risk in financing foreign shipments if they are to cash in on the big foreign market which undoubtedly is available. The advisability of such a step gets back eventually to the accuracy of the knowledge possessed by the domestic firm concerning its representatives in foreign countries and concerning the foreign markets.

A recent report from Spain sent out by the Automotive Division of the Bureau of Foreign and Domestic Commerce after stating that "American automobiles will probably continue to enjoy preference in the Spanish market" points out advantages enjoyed by our competitors for automotive business and adds:

"The method of doing business of these competitors should be another factor of concern. They are sending the cars on a consignment basis, and in view of the fact that Spanish dealers cannot be sewed up in ironclad contracts with American houses at the present time, these competitors are at a big advantage."

The matter of financing foreign shipments is one for individual treatment, of course, but there is every general indication that the American automotive exporter in the future will have to operate more as a real merchant—as in his domestic business—and less as a mere supply house for cash purchases.

Better Starting Facilities Needed

WE are more than ever convinced that every car produced to-day should be fitted with some device beside a choke to facilitate starting. Even in temperatures such as those which prevail in most of the northern States during nine or more months of the year many if not most makes of cars require an undue amount of cranking before a start is effected. As a result several difficulties arise which might be avoided and these are of a kind which often cause the owner a maximum of dissatisfaction, not to say disgust. Every manufacturer who aims to give the ultimate consumer of his product the greatest satisfaction from its use, and only such can hope to succeed in the long run, should give this matter careful consideration.

Failure to make a quick start usually results in prolonged periods of cranking which discharge the battery and thus react unfavorably, to a greater or less extent, upon the ignition system, adding a further uncertain element to the starting conditions. When the choke is closed, as it frequently is during most of the starting period, large quantities of fuel are discharged into the cylinder, much of it ultimately reaching the crankcase, where it dilutes the oil and helps destroy its lubricating value. It is probable also that the flooding which comes from excessive use of the choke results in the formation of a mixture which is so rich that it cannot be ignited even by the best spark that can be produced. Until this over-rich mixture is expelled from the cylinders no start is possible. This leads to the suggestion that the choke operating mechanism be fitted with a spring so that it will return to its open position when released by the operator. A small dashpot might be added in some instances if the introduction of a time element proves desirable. In any case some means should be used to make the occurrence of flooding less likely.

Priming devices with and without electric heaters have been successfully employed in some instances and a few cars are provided with some special form of vaporizer or ignition device which is operative only during the starting period. Many cars start easily under most conditions without any special auxiliary apparatus, while others, sometimes of the same make, are always hard to start. It is not always apparent why this difference exists. No doubt different reasons apply in different cases. A study of these reasons should be made a part of any investigation of the subject and every instruction book should contain explicit instructions to guide the driver in making a quick start.

A discussion of the subject in the Forum by engineers who have had experience in this line will be welcomed and should prove profitable to all concerned. We know of no one improvement which seems likely to yield larger returns in helping to bring about freedom from trouble of a very annoying nature. Fuels marketed in this country have a lower percentage of volatile fractions during the summer months. Consequently the problem is one of immediate importance even though it is usually more serious in cold weather. It is not too soon to start efforts to solve it now.

Sales Boom Brings Parts Shortage

Affects Specialized Car Field Seriously

Stock Chasers on Road — Shipments by Express—Orders by Wire

By D. M. McDONALD

DETROIT, April 25—Passenger car business in the Detroit district has progressed to a point where the already slender store of parts and materials has been reduced to the vanishing point in a great many instances and in some cases has been entirely wiped out. The big battle of the moment is not to get business, but to get material.

Passenger car makers again have stock chasers on the road in an attempt to speed up deliveries and many shipments of smaller parts and accessories are being ordered by express.

Car makers in the specialized unit field are particularly hard hit for the shortages are not confined to any one unit. In other cases the body makers have fallen behind, but the serious shortage is with the specialized unit maker.

This shortage is most serious because of its origin in the basic metal and the impossibility of getting around the time required for treatment of the metal before it can be made up into the parts. A sudden shortage of malleables has been discovered in more than one plant and malleable stores cannot be replenished over night.

Need of Skilled Workers

In the body making field the serious shortage is skilled workers. Newspapers here are carrying advertisements for men specializing in the various processes of body making, but the ranks are very slow in filling. Some companies feel a shortage of space which will be overcome by the addition of new buildings, and in the meanwhile body contracts are being sub-let by manufacturers or placed elsewhere than in the crowded shops by the car maker.

The Timken Axle Co. is installing new equipment in several of its units to meet the onslaught of orders. Deliveries have fallen behind, it is admitted, but with the new equipment the company will get back to an even footing soon after May 1 and will be entirely caught up by May 15.

(Continued on page 940)

Business in Brief

NEW YORK, April 25—A "profound improvement" in business conditions is reported by the Department of Commerce after a compilation of the latest commercial and industrial statistics. Optimism is based upon the better fundamental conditions throughout the country.

Two outstanding features noted by the department are the marked increases in iron and steel activity and the big increase in construction.

Reports from all steel centers indicate that demand is constantly growing. Production ranges from 75 per cent to 80 per cent of capacity, and incoming orders are considerably in excess of production. The coal strike appears to have affected industry but little.

Freight car orders placed by the railroads of the country thus far this year aggregate 51,791, as compared with a total of only 28,358 for all of last year. It is expected 20,000 more will have been ordered by May 1.

Unemployment is rapidly decreasing and there is an actual shortage of skilled workers in many lines.

More life is apparent in primary markets for textiles and cotton goods.

Lumber and building supplies are leading the way, but the market for agricultural implements and vehicles is stronger than at any time since the slump in farm prices in 1920.

Crop reports are irregular, as they always are at this time of the year. They are based largely on weather conditions, and the late arrival of spring weather as well as floods in many sections. On the whole, however, they are favorable.

Stocks are somewhat irregular, but prices, in general, continue to advance. Bonds are active and firm, money easier and exchange steady.

Bank clearings for the week ending April 20 aggregated \$7,035,495,000, a gain of 5 per cent over the preceding week and 15.2 per cent over the same week last year.

Total car loadings for the week ending April 20 showed a material decline because of the coal strike, but the loadings of miscellaneous freight and merchandise showed a continued gain.

Production in May Will Be Up to April

Passenger Car Factories Near Capacity—Truck Plants Reach 50 Per Cent

By JAMES DALTON

NEW YORK, April 25—With April production of motor vehicles running far ahead of March it now is certain that May will show an equally large output, although the percentage of gain over the same period in 1921 will not be as large as in the first quarter. Factory after factory is speeding up its output and preparing for still larger schedules next month.

Manufacturers of many of the more popular passenger cars are approaching capacity. Sales of some of them are limited only by output. Dealers in several lines are unable to promise deliveries in less than two or three weeks. The bulk of the business remains in the lower and middle price classes, although a few companies in the higher price field are approaching capacity operations.

A majority of the companies which produce trucks on a quantity basis are running at 50 per cent of capacity. It is confidently predicted that, if the general business revival continues until fall at the present rate, commercial vehicles will be absorbed as fast as they can be turned out. The demand for light trucks which began two months ago has increased rapidly, and sales of heavy-duty vehicles now are becoming brisk, chiefly for highway and building construction work.

Tractor Business Better

Price reductions in the tractor field have stimulated business to a surprising degree. At least three companies are operating at capacity in the production of the lighter models. Their ready sale is evidence of improved conditions in the agricultural districts.

At the beginning of April only a comparatively small number of parts plants were operating at more than 50 per cent of capacity. Since then the number in this class has increased amazingly. Several are running full blast, and probably 70 per cent of capacity would be a fair average for

(Continued on page 940)

Stockholders Ratify Willys-Overland Plan

No Dissenting Vote in Authorizing Bond Issue to Fund Bank Debt

TOLEDO, April 24—Preferred stockholders of the Willys-Overland Co. at a special meeting here to-day ratified without a dissenting vote the proposal made by the directors for funding of the bank debt through the issuance of \$17,500,000 of 7 per cent first mortgage bonds, to mature Dec. 1, 1923. The bonds will be taken up by the banks which had extended the company's loans for several months and will have the effect of pledging the fixed assets where formerly only current assets were involved as security for the loans.

The plan was developed by the board of directors after a majority had been drawn from the ranks of Toledo business men. Plans for the liquidation of securities owned by the company and for conversion of real estate holdings into cash with which to pay off the bonds are going forward, according to plant officials.

The production of the plant here has passed the 400-a-day mark, and the total for the second quarter of the year will surpass 30,000 cars, which is more than double the production during the same period a year ago. More than 8000 men are now at work in the plant in this city, and more are being added as rapidly as materials can be secured to boost production schedules.

Secretary L. A. Miller announced that enough assents of preferred stockholders of the Willys-Overland Co. to the reorganization plan for the Moline Plow Co. are being received to insure adoption of the plan.

Tire and Valve Companies in Canada to Consolidate

OTTAWA, ONT., April 24—Within a few days it is expected that the merger of the Lion Tire & Rubber Co. and the Mead Universal Valve Co., Ltd., will be agreed to by the two lots of shareholders and the company be incorporated under Dominion charter to be known as the Lion-Mead Tire & Rubber Co., Ltd.

A site for the factory has been located in Hull, P. Q., and all plans are ready for the start when the merger is assured. The plant will manufacture tires, tubes, valves and other accessories.

Stockholders Soon to Get Plans of Pierce-Lafayette

NEW YORK, April 24—Details of the plan for the merger of the Pierce-Arrow Motor Car Co. and the Lafayette Motors Co. are being worked out as rapidly as possible and probably will be submitted to stockholders in a short time. The consolidated company, in addition to an exchange of stock, is expected to issue

Caution Is Still Necessary in Returning Industry to Full Strength

By B. F. EVERITT,

President of the Rickenbacker Motor Car Co.

Detroit, April 24.

THOUGH there is a tremendous buying field for automobiles to-day and the sick child is apparently again a thriving infant ready to resume its development where it left off two years ago, it is unwise for manufacturers to assume too much from appearances. There is still a great deal of nursing to be done before the infant is as well as it should be. There is no reason to think that the malady has as yet entirely disappeared.

The manufacturer must guard against the accumulation of the evils of sudden prosperity and keep his sails trimmed to meet every wind. Rickenbacker Motors and probably every motor car manufacturer is operating to-day with a large number of orders ahead. It is our intention to keep our orders definitely ahead of output. In this way we will know where our materials are at all times. When sales fall off our manufacturing plans will always be within control.

The experience of the past two years has shown the inadvisability of stocking up dealers with cars to help the factory in unloading merchandise commitments and inventories. Factories to-day must place their organizations on a definite footing and fix the remunerations on a basis commensurate with the actual value of the services rendered. Mistakes have been made in the past under the impetus of boom periods.

Then, too, there has been a tendency to stagnate the working efficiency of organizations by adding too many assistants. Lack of personal touch has been a serious drawback to the industry in the past, particularly in the few years preceding the 1920 crash. The automobile has passed from the field of experimental products. It is now a staple, necessary in every field of human endeavor. Cars will be made better and better as time passes and there will always be a sane and steady increase in demand. By gauging manufacturing strictly by market requirements, there will be no recurrence of the glutted periods through which we have just passed.

\$10,000,000 or \$12,000,000 worth of notes and bonds. The proceeds will be used to pay off bank loans of Pierce-Arrow which approximate \$8,000,000, as well as the bank loans of the Lafayette company, and provide working capital in addition.

The capitalization of Pierce-Arrow consists of \$10,000,000 in 8 per cent preferred stock and 250,000 shares of no par value common. It has no funded debt.

The Lafayette company has outstanding \$4,000,000 7 per cent preferred and 40,000 shares of no par value common. It also has no funded debt.

Priority in Lincoln Claims Enters into Case

WASHINGTON, April 24—Attorney General Daugherty has instructed Assistant Attorney General Riter to go to Detroit immediately to take special charge of the government's case against the old Lincoln Motor Co. and to press the claim vigorously.

Exception to the receiver's allowance of the claims of the 900 creditors will be taken by the government, it was announced. Daugherty called attention to the fact that the receiver already had approved claims filed by other creditors amounting to more than \$4,000,000, while nothing had been allowed to the government.

"The government's claims, instead of sharing with the others pro-rata, should have taken priority," he said. Should the government's claim for priority be allowed, it will result in the other 900 creditors losing heavily, the Department admitted.

High Freight Rates Check Western Sales

Edsel Ford Says They Must Be Lowered to Complete Business Improvement

NEW YORK, April 20—In the opinion of Edsel B. Ford, president of the Ford Motor Co., who came here to attend a demonstration of Fordson tractors in Long Island City, transportation costs are checking orders from the western agricultural states for cars, trucks and tractors. He believes freight rates must come down before business difficulties can be ironed out completely.

The Fords do not believe the fuel problem will become serious, even should there be a shortage of gasoline. Their company now is selling considerable benzol which is mixed half and half with gasoline for motor cars. It also has conducted encouraging experiments with alcohol.

Ford's European business has shown a material increase in the last month and a half, and sales abroad now are running from 11 to 12 per cent of the total business. Ultimately the Ford company will probably build plants both in Germany and Russia, but it has no intention of doing so in the near future. Ford made a significant statement that the company hopes to develop its foreign business to such a point that it will prepare practically the maximum production of parts the year round at its works in Detroit.

Last Scripps-Booth Car Leaves Factory

Plant Inventory Disposed of— G. M. C. Provides for Servicing Discontinued Line

DETROIT, April 22—The task of disposing of the inventory of Scripps-Booth Corp. has been accomplished and the last cars of this make to be manufactured have been shipped from the factory here. Although it was generally known for some months that the Scripps-Booth models would be discontinued, demand for the cars continued until the entire stock was sold.

General Motors Corp. decided to discontinue because the market for that type of car was not broad enough to sustain quantity production. Adequate provision has been made by General Motors for the service requirements of all Scripps-Booth cars now in the hands of owners.

A complete stock of all parts of the cars will be handled by the Scripps-Booth Service Division of General Motors with stockrooms in the former Northway engine plant and headquarters in the General Motors Building. Some branch service stations will be located in important cities of the country when complete servicing plans are worked out.

Dealers Handling Other Products

Many of the former Scripps-Booth dealers are now handling other General Motors products. In Detroit the Scripps-Booth branch has taken over the used car business of Oakland and is also handling Samson tractors and trucks. Places have been made in the General Motors organization for many of the former Scripps-Booth factory personnel. A. H. Sarver, president and general manager, is continuing for the present in charge of Scripps service work.

The Scripps-Booth plant is being rapidly equipped for the production of Buick closed body cars. Parts for all Buick closed cars will be shipped from the Flint plant and assembled in Detroit. This has been done to provide greater factory space for Buick and to do away with the necessity of shipping the bodies, built in Detroit, to Flint.

G. M. C. Will Complete Truck Plant at Pontiac

PONTIAC, MICH., April 22—Decision has been reached by the General Motors Corp. to complete the building expansion program at its truck plant here. The expansion was decided upon and an appropriation made in 1920 which contemplated enlarging the capacity of the plant to 25,000 trucks annually. This was carried forward to the point that the new machine shop was finished and equipped, and the new assembly line arranged.

The test house had been partly completed before the cessation of building

and is now to be pushed forward. It will make possible a capacity of 100 trucks daily. The plant has been operating on a production of 35 machines daily recently, a number that will not be sufficient if the present run of orders continues for a few weeks longer.

Very good prospects for business on the new motor-bus model being turned out are reported by the sales department. The new bus is making an appeal because of the design, aimed to prevent sideway and to promote comfort and ease of driving.

New Harley Financing May Prevent Receivership

SPRINGFIELD, MASS., April 24—That the affairs of the Harley Co. are in a way to be adjusted satisfactorily without the appointment of a receiver was stated to-night by an officer of the company. Arrangements are said to have been made with a New York bank to write a \$1,250,000 mortgage to take up the first mortgage for \$725,000 held by the Hendee Manufacturing Co., and cover a bond issue and provide some additional working capital.

The matter of a receivership, for which a petition was filed recently in the United States Court in Boston, has been postponed until May 1. It is believed that the refunding of the company's indebtedness will have been made in the meantime, and the occasion for a receivership removed. The company has just booked a substantial order for drop forgings for automobile parts to be delivered to a Cleveland manufacturer.

Oakland Will Adopt Flat Rate Generally

PONTIAC, MICH., April 24—The Oakland Motor Car Co. has decided to put into effect as quickly as possible a new plan of universal "flat rate" charges for service. The majority of its branches, distributors and dealers already have established this plan. Specialization on a piece rate basis is expected to do away with complaints from motorists that they never have any idea what a specific repair will cost until after the job is completed.

Another feature of service work by the Oakland company is the training of mechanics in a special school at the factory. These mechanics go back to the branches and distributors, and in turn open schools for the training of service men for Oakland dealers.

NO BIDS FOR ALLEN ASSETS

COLUMBUS, April 22—Although a number of possible bidders from Chicago, Detroit, Cleveland and Toledo were present when the assets of the Allen Motor Co. were offered for sale, no formal bids were made. After waiting for a time, James M. Butler, representing Receivers W. C. Willard and George A. Archer, announced that another effort to sell the property would be made June 6 at 10 a. m.

No Halt in Business of Gillette Rubber

Receivers Were Appointed to Prevent Embarrassing Moves by Hostile Creditors

EAU CLAIRE, WIS., April 24—To insure the continuation of the business without interruption and enjoin any creditors from taking steps which might interfere, the United States court has appointed C. W. Lockwood and Frank C. Herman as receivers of the Gillette Rubber Co., with authority to continue the business and requiring creditors to file their claims with the court before June 1. The receivership was made effective in the determination of litigation brought by an Illinois creditor. Counsel for the Gillette company made the following statement:

The condition of the Gillette Rubber Co. has been improving daily for the past several months. The company is solvent and its business is increasing. The receivership proceedings were friendly in character and are for the purpose of preventing hostile creditors from embarrassing the operation of the plant when the present creditors' agreement expires April 30. Plans for reorganization are developing but it will take considerable time to work them out, and to give this time the only way is to put the company's affairs in the hands of the court's receivers.

Full Faith in Receivers

C. W. Lockwood and Frank C. Herman, president of the Gillette Rubber Co., were appointed receivers, and Messrs. Aaron & Aaron of Chicago, and Roy P. Wilcox of Eau Claire were appointed by the court as attorneys for the receivers. The receivers will continue the operations of the plant under broad powers and will really be in better shape to carry on the business efficiently than the company itself could have done under existing conditions.

The character and ability of the men put in charge by the court is a guaranty that the company interests, including those of stockholders and creditors alike will be prudently and honestly administered. I think there is no doubt that within a short time the reorganization plans will be carried out in a way as to preserve this splendid industry for Eau Claire and establish it on a firmer and better basis than ever before.

Bill for Rural Post Roads Will Be Acted On Shortly

WASHINGTON, April 24—Prospects for early action on the Dunn bill, authorizing \$65,000,000 for construction of rural post roads in 1923 and \$75,000,000 the year following, were assured when the bill was placed on the Union Calendar of the House and will come up for action by Congress within the next week.

Recommendation that the bill be enacted was made by the Committee on Roads after hearings were held with the Secretary of Agriculture, the Director of the Bureau of Roads, the Chief of the Forest Service and others.

Optimism Features Firestone Meeting

**Business Everywhere Is Showing
Gains, Sales Representatives
Report at Conference**

AKRON, April 25—Seven hundred field men, sales representatives and branch managers of the Firestone Tire & Rubber Co., from as many cities in the United States and Canada and from the principal tire distributing centers of Cuba and Mexico, united at their annual conference here in sending broadcast a message of cheer and optimism with the declaration that business everywhere is showing substantial signs of complete recovery.

At the opening session of the three-day conference, General Sales Manager L. G. Fairbank announced that Firestone was near its peak production with a daily output at present of nearly 24,000 tires and 25,000 tubes, as compared to a peak in 1920 of 28,500 tires a day.

Firestone representatives from the Northwest reported that the lumber business is picking up rapidly. Western and Midwestern states are showing strong gains, while the improvement in farming localities brought about by the upward trend of farm produce prices is reflected in stimulated sales of automobiles, trucks and tires.

"The time for optimism is now," Fairbank said. "Our survey of the country, gleaned from the individual reports turned in to us by men at the conference, show that business is coming back rapidly and that prosperity is just ahead. We expect tire production to continue its steady gait and look for steadily increasing sales."

The field representatives, after a series of business and sales talks, were taken through a series of booths demonstrating window displays. The conference closed Wednesday night.

Paris Automobile Show Will Be Held Oct. 4-15

PARIS, April 11 (by mail)—Wednesday, Oct. 4 has been fixed as the opening day of the Paris automobile show, to be held, as usual, in the Grand Palais. The show will close on the evening of Oct. 15. This decision which puts the Paris show at the head of the European series has only been taken after considerable hesitancy on the part of manufacturers and dealers.

The Paris show will be on the same general lines as the one held last year. It will include every branch of the automobile industry, with a special building for trucks and tractors if necessary. American firms can only get space in the show after the requirements of other nations have been met. This restriction is adopted as a protest by the French industry against America's policy of a 45 per cent import duty before the war.

Automobile manufacturers who do not

rent a stand in the Palais will not be allowed to exhibit cars on body makers stands. This will particularly affect Rolls-Royce and Ford. These two firms decline to exhibit at the Paris show, but large numbers of Rolls-Royce cars are always to be found on body builders' stands, and Fords with mechanical modifications or unusual types of bodies are always on view in big numbers.

A further refund has just been made on last year's Paris show rentals, making a total of 50 per cent refunded to exhibitors.

Sees Dunlop Resumption at Buffalo Coming Soon

BUFFALO, April 22—Production is soon to be begun at the \$25,000,000 tire plant of the Dunlop company here, Albert L. Kinsey, president of the Buffalo Chamber of Commerce, told the members of the Equality club of the Central Y.M.C.A. to-day.

"There have been many rumors regarding disposition of this plant," Kinsey said. "Recently the Chamber of Commerce had communication with a large automobile firm which contemplates changing its location. The Dunlop interests were approached to determine if their plant is available for purchase."

"Those who approached the Dunlop company were informed that its American plant is not for sale at any price. The impression was given that commercial production of tires will be begun in the near future, probably in the early fall."

Chassis Lubricating Corp. Locates Plant at Monroe

NEW YORK, April 24—The Chassis Lubricating Corp., which has been conducting experiments for three years on a chassis lubrication system, has located its factory at Monroe, Mich., and has an assembling plant at 1926 Broadway, New York.

The company is incorporated in Delaware for \$1,200,000, and the officers are Rex W. Wadman, president; Fred H. Gleason, chief-engineer, and Martin W. McCloskey, secretary and treasurer. The directors are Fred H. Gleason, Joseph Van Blerck, E. V. Rippingille, George V. Codrington and N. G. Rost. Van Blerck is the head of a factory producing marine, aerial and truck engines and Rippingille is president of the Watson Stabilizer Co. and until recently was sales manager of the Hudson Motor Car Co.

AWARDED STAR GEAR CONTRACT

SYRACUSE, April 24—The New Process Gear Co. of this city has been awarded the contract for differential gearsets for the new Star. Gears for the car have been produced at the local plant for some time. The factory is now operating nights in some departments and approximately 700 persons are employed. The company is also making gears for the Willys-Overland.

Durant May Obtain Plant at Elizabeth

**Likely to Be Only Bidder When
Property of Willys Corp. Is
Auctioned in June**

NEW YORK, April 24—Durant Motors, Inc., probably will be the only bidder for the big new Elizabeth plant of the Willys Corp. when it is put up at auction by the receivers June 9. An auction sale has been decreed by the Federal court, and private sale of the property, therefore, is not permissible. No definite information is available as to the amount which will be bid, but it is understood it will be about \$500,000 less than the \$4,000,000 which the receivers have asked Durant to pay. The original cost of the plant was about \$10,000,000.

If Durant obtains the property, as it is expected he will, it is probable the Long Island City factory, which was equipped to turn out the Durant four, will be leased and the Elizabeth plant used to produce the Durant line, as well as the new Star. The primary purpose of the purchase, however, will be to provide space for assembling the Star in quantities.

The Elizabeth factory is said to be the largest automobile plant in the world under one roof. It covers 38½ acres, and it contains 1,200,000 sq. ft. of floor space. It was built to produce 250 six cylinder cars in an eight-hour day, or 500 if the factory was operated in two shifts. It would be possible to assemble in it at least 1000 Stars a day. It is probable that one end of the plant in which much machinery has been installed will be leased by Durant if he bids in the property.

Could Start Star in Quantities

Purchase of the Willys factory would permit quantity production of the Star almost immediately, as well as increased output for the Durant four.

A. T. Sturt, chief engineer of the Durant Motor Car Co. of New York and engineers representing the Continental Motors Corp. have been devoting their time for the past three weeks to thorough road tests of the Star. These tests have been made over rough country roads in Virginia and other Southern States. They have been designed to demonstrate the endurance of the new car and are reported to have been entirely satisfactory. It is said the little car has averaged 30 miles per gallon of gasoline in the difficult tests to which it has been subjected.

TRUCK FOR TOURISTS

SAGINAW, MICH., April 21—The Ruggles Motor Truck Co. has entered a truck for the 1922 tour "Around Lake Michigan." The truck will be of special design to carry baggage for tourists and will be mounted on a 2-ton chassis to travel at a passenger car speed. The body will have three decks for baggage, with a capacity of 110 suit cases.

General Motors Makes Special Export Line

Producing New Buicks and Chevrolets in Canada to Meet Foreign Tastes

NEW YORK, April 22—A special line of Buick and Chevrolet phaetons is being put into production for the export trade at the Oshawa, Canada, factory under the control of General Motors Export Corp. In making the announcement, officials of the export company stated that the new automobiles, which mount much extra equipment, had been added to meet an overseas demand for cars with different colors and different equipment than the standard lines.

Coincident with the New York exposition, Buick announced a special maroon roadster on the six cylinder line. The new models from Oshawa carry out the same purpose. The six-cylinder phaeton models are finished in either blue with black wheels or maroon with natural wood or maroon colored wheels. The top is of special material, with glass side windows and natural wood bows. The equipment includes electric tonneau light, nicked foot scraper, rubber trimming on the running board, transmission lock, gasoline tank under cover, Alemite lubrication, front bumper and radiator thermometer. The seven passenger model is furnished with a power driven tire pump. The four cylinder Buick is finished in blue and is provided with much of the same equipment.

The new Chevrolet is finished in green, with gold stripe trimming and black fen-

ders. The top is of improved waterproof material, in either black or drab. The instrument board is illuminated and cord tires are standard. Fuel feed is by vacuum system, with tank at the rear of the body, differing from the standard model. The radiator is of nickel finish and the car carries a front bumper.

S. A. E. Names Committee to Aid Road Development

NEW YORK, April 22—The Society of Automotive Engineers has appointed a highway committee to bring together the research and educational activities of the society along highway lines. Herbert Alden is chairman of the committee. The other members are: W. A. Brush, F. A. Whitten, George Green, W. E. Lay and H. C. Dickinson.

The society feels that the automotive engineer has not had enough to say in the direction of highway development, and that as a consequence the construction of highways has not been carried forward with enough consideration for the needs of the vehicle which is to use the roads. The mechanical side of the question, it feels, has naturally been neglected by the civil engineers who have done the highway work.

ASKS BOSCH INQUIRY

WASHINGTON, April 24—Investigation by a special Senate committee of the administration of the Alien Property Custodian's office, especially the sale of the Bosch Magneto Co., has been asked in a resolution introduced by Senator King of Utah which has been referred to the judiciary committee.

Government to Make Tire Survey Abroad

As Result of Conference Official Will Go to Europe to Determine Market

WASHINGTON, April 21—A survey of the European automobile tire market will be made by the Department of Commerce, it was announced to-day by the Rubber Division, following a conference of national tire builders and rubber dealers.

Dr. P. L. Palmerton, chief of the Division, will sail for Europe immediately and make an exhaustive study of that country as a market for American made automobile tires and other rubber goods products. This will be the first foreign survey ever made by the government, in an endeavor to find a foreign market for United States rubber and tire exporters.

The scope of the survey, it was announced, will comprise practically the whole of reconstructed Europe and will require, it is expected, ten months or a year to make.

Among those who attended the conference to-day and endorsed the survey of the department were: F. E. Titus, chairman, B. F. Goodrich Corp.; A. G. Lubke, vice-chairman, General Tire & Rubber Co.; A. R. Gormully, Ajax Rubber Co.; Harry Braender, Braender Rubber & Tire Co.; F. K. Espenhain, Goodyear Tire & Rubber Co.; D. D. Yard, Pennsylvania Rubber Co.; George S. George, Federal Rubber Co.; K. S. Chamberlain, of the Fisk Rubber Co.; C. E. Wagner, Miller Rubber Co., and E. H. Huxley, United States Rubber Export Co.

Representatives of Industry Discuss Export Problems



The meeting of the Contact Committee formed from the automotive industry for cooperation with the automotive division of the Bureau of Foreign and Domestic Commerce marks the first occasion upon which representatives of all phases of the industry have come together for a joint discussion of foreign trade problems.

Reading from left to right the members of the committee are: (Seated) George F. Bauer of the National Automobile Chamber of Commerce; Dr. Julius Klein, director of the Bureau of Foreign and Domestic Commerce; T. F. Cullen, Automobile Trade Journal; G. W. Brogan and S. D. Black, representing the Automotive Equipment Association; M. L. Hemlinway, general manager of the Motor and Accessory Manufacturers Association; Luther K. Bell of the Aeronautical Chamber of Commerce; George E. Quisenberry of the Glass Journal Co.; M. P. Hoepli, assistant chief of the automotive division of the bureau; W. G. McCann of the Motorcycle and Allied Trades Association; Norman G. Shidle of Automotive Industries and M. Lincoln Schuster and S. S. Meyers of the M. A. M. A.

Among those standing are Gordon Lee, chief of the automotive division who organized the committee, second from the left; J. Walter Drake, chairman of the foreign trade committee of the N. A. C. C.; W. O. Rutherford, chairman of the foreign trade committee of the M. A. M. A.; L. E. Warford of the N. A. C. C. and Ira Hands, secretary of the National Association of Engine and Boat Manufacturers.

Edge Trade Body Bill Has Life Assured It

New Jersey Senator Will Push Legislation Defining Activities of Associations

WASHINGTON, April 24—Legislation presented to the Senate by Senator Edge of New Jersey, designed to define the activities of trade associations, is not to be allowed to sleep in the files of the Judiciary Committee, according to the Senator. His resolution has developed a great deal of support among trade organizations, and letters are being received by members of the Senate and House approving it. Senator Edge said:

I have no intention of permitting the important subject of defining the power of trade associations to be dropped. After two days' debates on the resolution providing for a joint Congressional committee to investigate the subject it became generally apparent that the opposition, realizing that by agreement the appropriation bill, immediately followed by a tariff bill, would necessarily displace the resolution on the calendar, and they therefore would not permit the vote.

I am reasonably positive that if there had been sufficient time and a vote could have been secured the resolution would have been passed. However, it is not important, as the main object of the resolution is covered by the bill I have introduced, which is in the Judiciary Committee.

The only difference in the present situation will be that the Judiciary Committee will hold public hearings and consider the subject rather than a special committee. So far as I am concerned, I am entirely satisfied with this procedure and have been assured by the chairman of the Judiciary Committee, Senator Nelson, that he will select a committee who will give full attention to the important schedule.

American Steam Truck Makes First Delivery

CHICAGO, April 22 — The American Steam Truck Co. this week delivered the first steam truck produced in its factory here. The truck is of four ton capacity and sells for \$5,000. C. R. Howard, president of the company, said that the factory is now producing at the rate of about one a week and that he hopes to increase the capacity to 20 a month.

The company is also building steam passenger cars and expects to have the first five completed between May 1 and 15. The first cars are to be 5-passenger phaetons and priced at \$1,650. It is expected to have a full line of passenger models later, Howard said, as well as to build trucks of five-ton and seven-ton capacity.

The company has made sales contracts for several states. A company composed of L. F. Gard, B. S. Edwards and C. A. Webb of Gary has contracted for the territory of Indiana and Michigan; A. H. Alexander of Webster City, for Iowa; J. F. Howard of Milwaukee for Wisconsin; H. A. Moje for Chicago and William M. Einhorn for Cook County outside of Chicago.

GENERAL MOTORS CORPORATION 224 West 51st Street New York, N. Y.

May 1, 1922

To the Stockholders:

The automobile is the largest unit of merchandise sold for cash to the individual consumer.

In the early history of the industry, as there was no parallel to follow, motor makers could not profit by the credit merchandising experience of other manufacturers. Today the merchandising of the automobile is upon the threshold of transition from a cash to a credit basis, similar to that through which has passed the merchandising of nearly every other product.


The selling and advertising force behind the marketing of automobiles has outstripped the progress of the credit machinery available to the industry. To supplement the credits which local bankers have extended to the automotive industry, a group of specialized financing companies entered the field and they have done pioneer work in credit merchandising.

The General Motors Acceptance Corporation was organized three years ago under the banking law of the State of New York as an associated independent banking institution to provide credit accommodations exclusively for General Motors distributors and dealers and purchasers of General Motors products. The functions of the General Motors Acceptance Corporation are to supplement existing local banking facilities, which accomplish two things: first—that General Motors distributors and dealers, with approved credit standing, are enabled to finance their purchases and sales upon a thoroughly sound banking basis; which in turn means, second—that General Motors Corporation is enabled to sell its products for cash. This necessitates the employment of much less working capital than would be needed were the Corporation itself to attempt to extend credits generally.

At this time of year the desire to buy automobiles is strongest and the demand by individuals for credit accommodations is greatest. Accommodations under the GMAC Plan are available only to those who measure up to proper credit standards. Our stockholders are all concerned in the financial success of General Motors. I am directing attention to the GMAC Plan of financing, which has been and will continue to be instrumental in augmenting sales, in order that the stockholders may fully appreciate this important part of our merchandising operations.

With a clear understanding of this, I am confident stockholders can and will co-operate in stimulating sales of our cars, trucks and other products.

Yours very truly,



President.

Facsimile of letter of Pierre S. du Pont

Selling of Automobiles Is Reverting to Credit Basis, President du Pont of G. M. C. Tells Stockholders

NEW YORK, April 25—The importance of the General Motors Acceptance Corp. in the selling system of the corporation is emphasized in a booklet, summarizing its operations, which is being sent to all stockholders. The booklet is prefaced by a letter, shown above, addressed to stockholders by Pierre S. duPont, president of General Motors and chairman of the board of the E. I. duPont de Nemours & Co., one of the largest industrial organizations in the world.

In his letter, duPont gives expression to a conclusion which the automotive industry as a whole has been slow to grasp. This is that "the automobile is the largest unit of merchandise sold for cash to the individual consumer" and that "the merchandising of the automobile is upon the threshold of transition from a cash to a credit basis." He adds a word of credit to the specialized financing companies which have done financial work in automotive merchandising to

supplement credits from local banks.

The booklet gives some surprising figures regarding the General Motors Acceptance Corp., which, it says, now ranks 120th among the banking institutions of the United States from the viewpoint of capital, surplus and undivided profits. Since its inception early in 1919 to April 1, 1922, the corporation has financed under its retail plan 146,937 cars, trucks and tractors, and 102,074 under the wholesale plan. This does not include the operations of the foreign department or the financing of other General Motors products.

As of Dec. 31, 1921, the company shows total assets of \$31,933,965. The total amount of financial accommodation extended since its organization has been \$227,743,664, divided as follows: Foreign, \$27,897,700; retail, \$107,802,979; wholesale, \$92,042,985. This means that it has financed General Motors cars of a retail value in excess of \$300,000,000.

Plants Speeding Up in All Branches of the Industry

Western Malleables Reopens Foundry

BEAVER DAM, WIS., April 24—The increased call for malleables from the automotive industries, railroads and other extensive users has made it necessary for the Western Malleables Co. to reopen its Center Street foundry, one of four large shops operated in that city. The first shop to re-open, namely, the Elm Street plant, has been operating for nearly three months and business is beyond its capacity. The other two shops are being placed in readiness for an early resumption of operations as the volume of new business requires further extension of available capacity.

Republic Truck Sales Increase

ALMA, MICH., April 24—F. E. Smith, president of the Republic Motor Truck Co., reports that both February and March sales showed an increase of 50 per cent over the preceding month and that April sales are running at a rate of 50 per cent improvement over March. The company has closed a contract with the United Railway & Electric Co. of Baltimore for twenty-six buses. This order was placed after a five months' test and a thorough investigation of bus operation in Europe and America.

Buick Has Big Schedule

DETROIT, April 24—Production of the Buick Motor Co. for the second quarter will be 27,000 cars, or 40 per cent greater than the first three months, President H. H. Bassett says. It will be 8000 more than the second quarter of last year and within 2000 of the 1920 second quarter, which was nearly a record. There is no abatement of business coming from large cities and within the past week surprisingly large volume of business has come out of Iowa and Nebraska.

Timken Back in Deliveries

DETROIT, April 25—The Timken Detroit Axle Co. is re-equipping a number of departments in several plant units which, when completed, will give it increased capacity. The company is behind in deliveries, but is distributing its output among its many customers so that no one will be without a proportionate share, by working extra shifts. The company declares it will be in a position to make immediate deliveries within thirty days.

Ford Output 4000 Daily

DETROIT, April 25—The Ford Motor Co. made the statement to-day that the five-day week announced by President Edsel Ford some weeks ago will not become effective until late in the summer, by which time the Highland Park plant will be re-equipped. Rush of business in the past few weeks has caused the company to resume its former six-day week schedule, and it is now running about

BIG SHIPMENT LEAVES G. M. CANADIAN PLANT

OSHAWA, ONT., April 24—A train of sixty flat cars carrying cases containing 304 Chevrolets, Buicks, Oldsmobiles and Oaklands, weighing 504 tons, shipped from the plant of the General Motors of Canada, Ltd., here, is said to have been the largest single export shipment ever started from a Canadian automobile factory.

The shipment will be transferred at the Atlantic seaboard to the steamer Canadian Conqueror for shipment to foreign ports, including Constantinople, Egypt and New Zealand.

It is said that General Motors has on hand enough export orders to keep the factory going full speed for several months.

4000 cars daily. No record production days have yet been reached, but the factory is slowly arriving at the point where new high marks for daily output may be expected.

Maxwell at Capacity

DETROIT, April 25—All plants of the Maxwell Motor Corp. are now operating at capacity. April production will be in the neighborhood of 6500 cars and that of May 7000 cars, which are substantial increases over the first part of the year. In January the production was 2000, February 2200, and March 3600.

500 Rickenbackers in April

DETROIT, April 25—The Rickenbacker Motor Car Co. will build 500 cars in April and will run far ahead of this total in May. The company has contracts with its dealers assuring 8500 cars will be produced in the balance of the year, and they will endeavor to increase this total to 10,000 for its first year's work. The equipment of the factory is now about completed permitting full production.

Truck Sales Gain 375 Per Cent

NEW YORK, April 24—The New York branch of the General Motors Truck Co. reports that thus far this year its business has been 375 per cent greater than in the same period last year.

March at 65 Per Cent Capacity

NEW YORK, April 24—Mack Trucks, Inc., is operating at about 65 per cent of a capacity production of 800 trucks a month and it is expected that within the next thirty days maximum capacity will be reached.

Kissel Boosts Schedules

HARTFORD, WIS., April 24—The Kissel Motor Car Co. has recently increased its working schedules so that its operations are now the equivalent of 75 per cent of capacity, three-fourths of its normal working force being employed on a ten-hour basis, or fifty-five hours a week, with a Saturday half-holiday. During the last fourteen to eighteen months the Kissel factory was operated between 35 and 60 per cent of capacity, according to fluctuations of demand. The present increase is justified not only by the improvement in the call for passenger cars and trucks, but for the Kissel special highway contractors' truck, which has special equipment.

Hendee Foreign Trade Better

SPRINGFIELD, MASS., April 24—In the first three days of last week the Hendee Manufacturing Co. received calls for 250 machines, total orders on hand running 800 ahead of production. Improvement in foreign trade is especially noteworthy, business with Holland showing marked gains. Last fall the Holland branch had over 700 machines on hand unsold; it is fast disposing of its stocks and has ordered 300 motorcycles to be shipped not later than May 30. Inclusive of this, the company has on hand orders for between 1100 and 1200 machines.

Hupp Has Biggest Single Day

DETROIT, April 25—Hupp Motor Car Corp. shipped 215 cars on April 17, the biggest single day's delivery the company ever made. Total April shipments up to that day were 2050. Total April production sought is 4000. March, with an output of 3005 cars, was the highest single month previously. President Charles D. Hastings said the impetus of buying extends to every part of the country with the exception of the exclusively cotton growing states in the Southeast.

Night Shift for Chevrolet

DETROIT, April 25—The Chevrolet Motor Co. has started a night shift for the first time in several months, the April schedule calling for approximately 10,000 cars. About 900 axles are being turned out a day and the production of engines totals 800 daily. Shipments of the company for February were in excess of 10,000 cars.

Atwater Kent Increases Force

PHILADELPHIA, April 24—The Atwater Kent Manufacturing Co., which is now operating at 90 per cent capacity, has increased its employees 150 per cent. It now employs a large night shift. The company expects the automobile trade this year to be the record of twelve months' previous in 1920.

Men of the Industry and What They Are Doing

Cravens Heads Climax Engineering

George W. Cravens, formerly associated with the American Motors Corp. of Plainfield, N. J., has become president of the Climax Engineering Co. of Clinton, Iowa. This company, which will manufacture internal combustion engines for all types of power driven machinery, is the successor to the old Lamb Marine Engine Co. which has devoted its efforts for several years to the manufacture of tractor engines, but which now is branching out into the industrial field generally.

Alvin Is U. S. Truck Sales Head

Forrest J. Alvin, general manager of the United States Motor Truck Co. of Cincinnati, has been appointed president and general manager of the United States Truck Sales Co. of St. Louis, to succeed J. F. Mackay. Mackay, who is vice-president of the National City Bank of St. Louis, has been elected chairman of the board of directors and of the finance committee of the St. Louis company.

Young Joins Spring Company

James W. Young, who was assistant general manager of the Oakland Motor Car Co. under Fred W. Warner for some years, and who retired after Warner's resignation, has become associated with the Spencer Spring & Axle Co. of Wilkes-Barre.

Crawford Resigns from Allen

J. M. Crawford, who has been chief engineer in charge of manufacturing for the Allen Motor Co., Columbus, has resigned, due to the postponement of the sale of the company from April 18 to June 6. Before taking up his work with the Allen company Crawford was connected with the Chalmers Motor Corp. as assistant engineer.

Frank Wolfe in Private Business

Frank B. Wolfe, assistant comptroller of the General Motors Corp. in charge of the cost division, has resigned to enter private accounting work in Detroit.

Moock Is Visiting Dealers

Harry G. Moock, assistant general sales manager of the Hudson Motor Car Co., in the course of a trip on which he is visiting dealers, spent a day with the New York organization and addressed the salesmen.

Gleason Joins Durant

C. D. Gleason has been appointed sales manager for the Dominion of Canada by M. B. Leahy, general sales manager for the New York, Lansing and Toronto plants of Durant Motors, Inc. Gleason goes to the Durant organization from the Chevrolet Motor Co., with which

he has been identified for several years. He was for a long time Chevrolet distributor at Winnipeg and knows the Dominion trade thoroughly. Later he was in charge of Chevrolet sales in the Pittsburgh division and more recently was transferred to the Chevrolet staff in Detroit.

de Vignier Leaves Fibre Company

R. M. de Vignier has resigned as chief engineer of the American Vulcanized Fibre Co., Wilmington, Del. de Vignier was connected for many years with the Western Electric Co. and the duPont company as development engineer and also produced the Mercury passenger car, work on which was stopped at the opening of the war. He is considering several proposals for the future, but has not yet announced any definite plans.

Lassiter May Head Merger

C. K. Lassiter, vice-president in charge of manufacture of the American Locomotive Co., has resigned, it being reported that he will head the new merger of machine tool manufacturing companies.

McDermott Now in Sales Work

Luke B. McDermott, factory manager of the Franklin Automobile Co. of Syracuse, has become connected with the sales department of the Martlew-Bamerick Co. McDermott has been associated with the automobile industry for many years.

McLuney at Peerless Branch

A. K. McLuney has been appointed manager of the Pioneer Motor Co., the Peerless branch in San Francisco with a sub-branch in Oakland. For many years McLuney was closely associated with R. H. Collins, president of the Peerless Motor Car Co., in manufacturing and sales, after which he embarked in the automobile business on his own resources.

Thurman With Equipment Makers

George Thurman, for some years connected with the Oakland Motor Car Co., has resigned to become secretary of the new United Automotive Equipment Co., which will have offices and a plant at Pontiac, Mich.

Barnett Succeeds Shaw

D. C. Barnett, who succeeded Lynn M. Shaw as secretary of the Youngstown Automobile Dealers Association, has taken Shaw's place as manager of the Indiana Automotive Trade Association. Shaw has assumed his position as assistant general manager of the National Automobile Dealers Association and has started on a trip which will cover fourteen cities in Texas, the Gulf States and the Atlantic Coast States.

Shugart an Officer of U. S. Rubber

At the recent organization meeting of the directors of the United States Rubber Co., George S. Shugart, vice-president and general sales manager of the United States Tire Co., was elected a second vice-president of the rubber company.

New Racing Officials Named

D. V. Nicholson, assistant secretary of the California Automobile Association, has been named official representative of the contest board of the American Automobile Association. He will direct the general work of the board in northern California and will officiate at the Greater San Francisco speedway races. D. J. Lafferty, Santa Rosa director of the state association, has been appointed official representative for the Santa Rosa district, and a third official is to be named to act at the Fresno speedway. E. F. Cheffins, who has represented the board at the California speedways in the past, is retiring after ten years' service.

West Has New Connection

Louis D. West, for several years connected with the Chilton Co. as Cleveland district manager, has resigned to become associated with the H. L. Rackliff Co., automotive marketing counselors of Cleveland and New York. He will have charge of the Rackliff organization's field work in Ohio, Indiana, Kentucky and western Pennsylvania.

Swinehart with Hannibal Rubber

C. A. Swinehart, after eight years' service with the Victor Rubber Co. as sales manager, has severed his connections with that company and has taken charge of sales of the Hannibal Rubber Co., Hannibal, Mo. Swinehart for seven years was associated with the Swinehart Tire & Rubber Co., directing sales.

Louis Staff in Own Business

Louis A. Staff, who recently retired from Staff Brothers Co., will continue for himself in the business of handling automotive equipment. He has opened offices in the Fisk Rubber Co. Building in New York.

Colt Goes to Distributorship

William L. Colt, for nearly five years division manager of Willys-Overland, Inc., in the Eastern district with headquarters at New York, has resigned to become the president and active head of the Overland Providence Co., Willys-Overland distributors for Rhode Island, a concern he established and financed about a year ago. Prior to his association with the Willys organization, he was for eight years president of the Colt-Stratton Co., New York.

Sales Boom Brings Shortage of Parts

**Affects Specialized Car Field —
Expedients Adopted to Get
Supplies**

(Continued from page 932)

Continental Motors Corp. declares it is fully equipped to meet all delivery requirements, but has been compelled to hold up shipments because of the non-delivery of other necessary parts to its customers. Shipments are being sent forward in the quantities that the makers of other units or bodies are capable of furnishing, so that inventories may be kept balanced.

Fisher Body Corp. has plans fully made to build an addition to its former airplane body plant, which has been practically idle since the war, which will give it an additional 1,000,000 feet of body manufacturing space in Detroit.

Sudden Demand for Bodies

The extent of body demand may be gaged somewhat from the fact that one independent body company has gone into production on 17 new types of bodies within 10 days. Some time will be required, the company declares, before capacity production can be reached on the new work, owing to the suddenness of the demand and the impossibility of getting skilled men quickly.

Other body companies report themselves as able to keep up to delivery requirements through employment of double shifts and overtime.

Incidental to the body situation, it may be reported that closed car demand is running 20 per cent higher than had been anticipated in most of the medium grade cars, and consequently deliveries of finished cars are running behind because of failure to authorize releases sufficient to meet the demand. Closed car commitments must be made at least 90 days in advance, a prominent maker said, to meet deliveries on schedule. Inability to gauge the extent of the spring closed car business is responsible, to a large extent, for the rush in the body plants.

No Shortage of Metal Stampings

There is no shortage of metal stampings and products of that character only because the manufacturers in those fields are working two and three shifts a day to keep even with demand. To enumerate plants working under pressure of this kind would mean to call the roll of every plant in the Detroit district.

Wheel makers, particularly those in the disk wheel field, are experiencing a heavy pull to meet which it has been necessary to enter upon overtime and double shift operation. In the frame assembly field there have been some slight delays which have been overcome.

Though it is agreed that the congestion of business could have been avoided by the spreading of orders for supplies over a longer period, it is also agreed that the present extent of the car de-

RAIL INTERESTS URGE DRASTIC REGULATIONS

ST. LOUIS, April 24—Members of the Traffic Club of St. Louis were advised in an address by Alexander C. Hilton, traffic vice-president of the St. Louis & San Francisco Railroad, to begin a close study of the automobile industry which, he said, is playing havoc with the receipts of the railroads. He suggested the appointment of a national committee of traffic club members to begin a campaign to have enacted more drastic regulations for automobile carriers and to see that those engaged in competition with railroads be forced to pay their share of the tax burden "now largely shouldered by the railroads."

mand could not have been estimated by anyone, parts maker included. It is also evident that, despite the rush of orders, buying on a 30 or 40 day basis will continue to be the rule for some time to come.

Production in May Will Be Up to April

(Continued from page 932)

that branch of the industry as a whole. Tire plants are increasing their output, and tubes and casings now are being produced at the rate of more than 24,000,000 a year.

So encouraging are conditions that the Ford Motor Co. predicts a production of 1,150,000 cars and trucks in 1922. This would establish a new record for that company.

The only factor delaying full recovery for the automotive industry is lack of complete confidence in the future. Business literally seems "too good to be true." With the lesson of 1920 staring them in the face, many manufacturers cannot believe that prosperity is returning definitely. As a consequence, buying of parts and supplies still is being done on a hand-to-mouth basis, and, except in rare instances, no stocks of cars are being built up. Production is being held rigidly to an actual order basis.

A.A.A. TO MEET IN ST. LOUIS

WASHINGTON, April 24—The American Automobile Association has decided to hold its annual meeting in St. Louis, May 22 and 23. The invitation was extended by William T. King, president of the St. Louis Automobile Club, who has been appointed chairman of the arrangements committee. King also has been appointed chairman of the committee to report on ways and means of conducting a national fight against automobile thefts.

Wisconsin Factories Keep Going Forward

**One Body Maker Is at 90 Per
Cent Capacity—Truck Plant
Increases Operations**

MILWAUKEE, April 24—Tangible evidence of the improved condition of the automotive industries in all phases in Milwaukee and Wisconsin develops every day. With the motor truck trade again getting into its stride there is added significance to the betterment first discernible in passenger car trade. Progress is being made slowly, but it is substantial. What already has occurred in this direction is strikingly the feature of the current issue of *Business and Financial Comment*, monthly review of local condition, issued by the First Wisconsin National, Milwaukee's largest bank, which says in part:

Working at Full Capacity

The automotive parts and specialties group (of metal trade industries) expanded operations further during the past month. A firm manufacturing bodies is running 90 per cent of capacity, against 80 per cent a month ago. A motor manufacturing concern augmented its force by 60 men in March. Another motor products firm is operating at full capacity. A firm making switches, motor wheels and other automotive and electrical specialties, reports operations at 85 per cent, and March sales 55 per cent in excess of February sales.

A large motor truck plant increased operations from 28 per cent on March 1 to 48 per cent on April 1. A large rubber tire company had 25 per cent larger sales in March than in February.

Analyzing the agricultural situation, the review says:

First hand information received by this bank from various parts of Wisconsin indicates that the farm sections of this state entered the spring season in fair shape. Opinion is quite uniform that the outlook for the year is good, provided prices remain stable.

It is quite generally felt, however, that most of whatever the farmers make this year will go to pay off their debt. This does not argue increase of farm buying power.

No Setback with Dealers

One of the most encouraging features of the situation of dealers is that there have been no setbacks in the upward trend of demand for passenger cars, and while the sales curve is still inclined to make peaks and troughs in its day-by-day course, these are less sharp than they have been for many months. There is not a dealer who cannot claim that in the first three weeks in April he moved more cars into owners' hands than in March altogether. April probably will close as the heaviest month in any of the past twenty to twenty-two months.

A. E. A. SHOW NOV. 13-18

CHICAGO, April 24—The annual show of the Automotive Equipment Association, which will be held at the Coliseum here, Nov. 13-18, will be a closed show, for members of the association only.

Minnesota Dealers Predict Good Year

**Sales of Cars Will Start as Soon as
Roads Are Opened and Sea-
son Opens in Country**

MINNEAPOLIS, April 24 — After June 30 what?

This question was put to a number of automotive dealers here, and their answer was: SALES.

The problem as to the automobile business after the second quarter was raised at a dinner given to the automotive dealers by Dunwoody Institute, here. The dinner was planned with a view of getting the dealers better acquainted with the educational work in the automotive mechanical course.

The question of future sales was raised in a talk made by Clyde Jennings, managing editor of *Motor Age*.

F. E. Murphy, publisher of the *Minneapolis Tribune*, a former automobile dealer, the owner of several farms and secretary of the Minneapolis Automobile Trade Association, was one of those who spoke for a full year of automobile prosperity.

Farmer Is "Good Sportsman"

"Our answer to your question," he said, "is that the Minnesota farmer will buy. He has been hard hit, it is true, but the Northwestern farmer is a good sportsman and is never down. In this connection it must be remembered that only the small grain farmer has been hit, and he is encouraged by the advancing price of grain. But in the Northwest we, also, have the dairy farmer, and in those counties where the monthly 'cream checks' are distributed, prosperity reigns and this district is constantly growing larger. There will be motor equipment of all kinds sold in Minnesota when the season comes in the country. Our good roads program is blazing the way."

The optimism as to car sales was not all at this dinner. Wherever one inquired in Minneapolis, he found the strong belief in the future. It is announced by the city Bureau of State License department that new car licenses are running more than double of a year ago. Exact comparison cannot be made because of the confusion of figures in the changing of the license system, but new car licenses since March 15 have been running from 65 to 140 daily.

This optimism is the more remarkable in the face of present conditions. Spring is very backward and the season is fully three weeks late. This fact is more apparent to the accessory and equipment dealers and jobbers than to the vehicle dealers. The vehicle dealers do not expect much business until the rush of spring work is past.

The equipment jobbers expect a rush of business as soon as the country secondary roads are clear. Last year the jobber salesmen quit the trains the last week of March and took to their motor

ARRIVAL OF MOTOR TRUCKS FOR MINNESOTA FARMS HAILED BY WHOLE COUNTRYSIDE

MINNEAPOLIS, April 24—The special light truck sales campaign of the International Harvester Co. in which about 5000 of these trucks, popularly called "red babies" have been sold since the first of the year, came to an end April 18 with the delivery that day by the St. Cloud branch of the company of 168 trucks to dealers of Northern Minnesota.

The St. Cloud branch, of which Wells Levens is manager, won first place for selling more of the trucks than any other of the 92 branches of the company. The Boston branch was second; Harrisburg, Pa., third; Denver, fourth; Kansas City, fifth, and Albany, N. Y., sixth.

The delivery of the trucks was marked by a "prosperity day" celebration under the auspices of the Chamber of Commerce.

This celebration was of such general interest to all business men of the state, including the entire automotive trade, that Governor J. A. O. Preus offered himself as one of the speakers in connection with a parade of this machinery.

It was significant in watching the parade of the new trucks that the farmer's buying power has returned.

Dan Wallace, editor of "The Farmer," brother of H. C. Wallace, secretary of agriculture, said:

"The celebration of the return of prosperity will prove of untold value to Minnesota. The eyes of the nation are turned here to-day and the hope of the nation is that the movement inaugurated here will gather momentum to sweep the world. The worst of the slump is ended."

Every farmer in St. Cloud for the celebration was the guest of the local merchants at a picnic luncheon.

This celebration was regarded as such a business stimulant that dealers and branch house managers from central and northwestern Minnesota, Canada, the Dakotas, Montana and Iowa were called in to join in it.

cars. This about trebles their calls and usually brings a rush of business from the small dealers in communities where salesmen do not go during the winter.

The trade in tractors and farm implements has continued better than was expected during the winter. It is said by the men making the best reports that a large share of their sales are going to the dairy counties and the buyers are "factory farmers" who sell cream and fat stock, rather than the usual farm produce.

Committees of N. A. C. C. Will Draft Road Plan

NEW YORK, April 26—A joint meeting of the motor truck and highways committees of the National Automobile Chamber of Commerce will be held at the Detroit Athletic Club next Tuesday. Members of the two committees will determine a program for presentation to the National Association of Highway Officials for discussion at its coming conference with representatives of the automotive industry.

The purpose of this conference is to map out some uniform plan for the construction of highways to carry motor transport and for the regulation of motor vehicles. Directors of the N. A. C. C. will meet at the Detroit Athletic Club next Wednesday.

GOODYEAR EXPORT COMPANY

AKRON, April 25—The Goodyear Tire & Rubber Co. has organized an export company with a capitalization of \$10,000. The officers are the same as those of the parent organization. The company was formed to take advantage of the large business which is now opening in foreign fields.

Stockholders Organizing to Buy Parent Assets

BUFFALO, April 26—Announcement was made yesterday that a stockholders' protective committee was being organized to raise sufficient capital to buy the assets of the Parenti Motor Corp. fixed at \$400,000, and to obtain sufficient working capital to go on with the production of cars. Plans are expected to be completed within two weeks.

Alfred M. Saperston, attorney for the trustee, the Marine Trust Co., yesterday said all attachments, judgments, executions and suits will be held in abeyance. The attorneys also have agreed to withhold a mortgage foreclosure action on the real property and plant.

Nearly all of the 200 creditors have signed consents in approval of the plan submitted by the trustee. As soon as the bank has decided whether the assets will be liquidated or the stockholders will buy the assets, the trustee will request creditors having liens to withdraw or waive their priority rights. A decision is expected by May 15. William A. McDougal, engineer of the Marine Trust Co., now has charge of the Parenti plant.

N. A. C. C. Service Managers Will Convene at Detroit

NEW YORK, April 26—The spring convention of service managers of factories members of the N. A. C. C. will be held in Detroit May 16 and 17. The sessions will be at the Statler Hotel, and much the same style of program will be used as proved so successful at the fall meeting in New York.

Two prominent men in the industry, whose names have not been announced as yet, will be the principal speakers.

Chevrolet Perfects Plan for Flat Rates

**Dealers Will Get It Next Month—
Provides for Major and
Minor Operations**

DETROIT, April 25—The Chevrolet Motor Co. will issue soon after May 1 15,000 copies of its flat service rate to its branches, dealer organizations and independent parts depots. Details of the plan which fixes a fair price on every major operation and most minor operations on both models of Chevrolet cars have been carefully worked out, and dealers will be expected to adhere to it closely.

In issuing the plan the company will not take an arbitrary stand in its enforcement, but will leave it to the dealer's initiative to recognize it as a definite step forward in promoting the interests of the company, the dealer and Chevrolet owners. Developments in the industry have impressed themselves on factory executives as demanding a basis upon which cost of servicing may be predetermined.

All Conditions Met

There are from 15 to 18 major operations on the car which are given numbers under the plan, and a large number of minor operations which are lettered. Where major and minor operations combine, these are set forth with the average time required for the work and the cost. Prices on genuine parts which may be installed are to be added to the cost of operations, giving the final costs.

Major operations are considered as those which require the removal of a major part, and minor operations those which are readily accessible. Minor operations which can be performed only by the removal of major parts assume the costs of both. In all cases the varying conditions which may be met in performing the work have been considered in fixing the time charge.

In a prelude to the plan it is set forth that the varying times fixed take into consideration the use of tools of certain general types which dealers will be expected to have included in their shop equipment. Where dealers expect to base their charges as outlined in the plan, it will be necessary for them to have similar tools.

Building Up Parts Depots

With the promulgation of the fixed rate service plan Chevrolet is building up through its dealer organizations a system of parts depots in independent garages located in strategic points throughout the country. These parts depots will be authorized as Chevrolet parts depots and will carry supplies of parts bought through the dealers at a fixed discount.

NEW NOBLE TRUCK

KENDALLVILLE, IND., April 22—The Noble Motor Truck Corp., this city,

has brought out a new 1½-ton model that lists at \$1,840 complete. This job will take an 18-passenger bus body on a standard 130-in. wheelbase.

Specifications include a Buda 3% by 5½-in. powerplant, Eisemann ignition, Stromberg carburetor, Long radiator, Fuller clutch and gearset, Blood Brothers driveshaft, Sheldon front and rear axles and a Sharon frame. Other equipment includes indestructible steel disk wheels mounted with 34 by 5-in. Miller cord tires, Stewart-Warner vacuum fuel feed, electric starting and lighting and Alemite chassis lubrication.

April May Establish Records for Industry

NEW YORK, April 26—There is a strong possibility that April production of motor vehicles will be the largest of any single month in the history of the industry. It is certain to be the largest in respect to carload shipments. The total of carload shipments for all manufacturers in March was 27,380, and there is every indication that this record will be exceeded by 25 per cent this month. If production does not establish a new high mark this month, it will be because of the enormous number of driveaways in some of the months of 1920, when there was an acute shortage of freight cars.

New Lexington Phaeton Is \$240 Lower Than Old

CONNEERSVILLE, IND., April 24—The Lexington Motors Co. has a series 22, 5-passenger phaeton, priced at \$1,745, which is \$240 less than the lowest previous price on a Lexington fitted with Ansted engine. In this series the Ansted engine has been refined and improved in many respects.

There is a new type, two ring piston, which is specially designed to prevent oil pumping and slapping. A thermostat is used to control the cooling system. The frame has a double triangular center cross member, and the front and rear cross members have been strengthened by deepening the gusset plates. Both front and rear springs have boots laced around them to retain lubricant and keep out mud and water. The other features of the car are essentially the same as in previous models.

G. M. OFFICERS RE-ELECTED

NEW YORK, April 26—At its annual organization meeting, the board of directors of the General Motors Corp. re-elected all officers for the coming year. Membership on the finance committee was increased from 10 to 11 by the addition of Alfred P. Sloan, Jr., vice-president in charge of operation.

SIZER TO GET HAMMOND STEEL

BUFFALO, April 25—The Sizer Forge Co. of Buffalo will soon take over the management of the Hammond Steel Co. of Syracuse, which is at present being reorganized.

Car Exports Double March of Last Year

**Shipments Were 4,471 Last
Month Against 2,019 in 1921
and 3,096 in February of 1922**

WASHINGTON, April 26—The international trade revival brought about large shipments of American automotive vehicles and equipment during March. This is strikingly shown by the export totals for that month, as announced today by the Bureau of Foreign and Domestic Commerce. The shipments totalled 4471 passenger cars, valued at \$3,831,432; 590 motor trucks valued at \$554,292 and parts, not including engines and tires, to a total of \$3,596,539. The tire shipments for the month were \$2,201,349.

The large gains made over the preceding month of February and a comparison with March, 1921, are indicated as follows:

	Passenger cars	Motor Trucks	Parts
	3096	454	
February, 1922	\$2,556,555	\$391,738	\$2,840,259
	2019	610	
March, 1921	\$2,348,378	\$877,781	\$3,098,535

The tire shipments in February totalled \$1,203,555. The upswing in export sales that began some months ago thus was continued through March at a total generally larger than any previous month since the latter part of 1920 or early 1921. The figures announced by the Commerce Department are only for shipments made from the United States and do not include the large volume now going from the Canadian factories.

G. M. Shipped 2239 Cars from Canada in March

NEW YORK, April 26—The overseas shipment of 2239 passenger cars from its Canadian factory during the month of March was announced here to-day by General Motors Export Corp., following the release from Washington of the export shipments of automobiles from the United States during that month. These Canadian totals do not show on the Washington figures. They compare with an approximate 1350 cars shipped by General Motors from Canada in February.

Of the March exports, General Motors shipped 1017 cars to its subsidiary corporation in the United Kingdom. To other parts of the world the totals were 1222. The increases over February were approximately 500 cars to the United Kingdom and approximately 400 to the rest of the world.

D. A. Laing, sales manager of the export company, says:

Our March shipments went to practically all territories. The Australasian division was first in number of cars shipped, with the Pan-American second and the European third. Australia and Argentina continued to take heavy orders and the decreased activity in Europe discloses the steady improvement being made in getting the Continent back to a more normal basis.

May Put Motor Cars On Big Four Branch

Officials Confer at Springfield— Plants in That City Increase Production

SPRINGFIELD, OHIO, April 25—Motor equipped trains may be operated on the Delaware division of the Big Four railroad within the next few months. This developed as a result of a conference between Superintendent Philip T. White of the Cincinnati-Sandusky division of the Big Four railroad, General Manager E. O. McDonnell of the Kelly-Springfield Motor Truck Co. and W. J. Foster, chief engineer for the Edwards Railway Motor Car Co. of Sanford, N. C.

The proposition was taken up a few days ago with Vice-President H. A. Worcester of the Big Four system, with headquarters in Cincinnati. It is understood that Superintendent White is favorably impressed with the proposition.

The Kelly-Springfield company is making a special drive for municipal business. During the past week it booked an order for four heavy unit Kelly trucks from the City of Milwaukee.

The Springfield works of The International Harvester Co. is keeping up its schedule of fifty light speed trucks daily. Superintendent Charles H. Smart states that orders are increasing and that foreign business is picking up.

The Westcott Motor Car Co. is rushing manufacture. The company is building all the cars it can with the limited amount of material available. The officers of the company say that April will be the best month in the past two years and that May promises to be even better. There were numerous shipments and drive-aways during the past week.

Business is improving at the plant of the Victor Rubber Co. Good sized shipments are being made, and the plant is being operated full time five days a week.

Mexico City Show Ends After Successful Week

NEW YORK, April 25—Successful sales of all classes of automotive equipment attended the annual motor show in Mexico City. Held under the auspices of the automotive division of the American Chamber of Commerce as a co-operative venture among the dealers in the Mexican capital, the exposition opened on April 16, and when the doors were closed after the week of exhibition, a total of 152 passenger cars, five trucks and ten tractors had been sold, with equipment and accessories to a total value of 800,000 pesos (\$400,000).

These results were announced in a cablegram from the Chamber of Commerce at Mexico City to *El Automovil Americano*, the Spanish automotive publication of the Class Journal Co. The cable states:

American Chamber of Commerce automobile show opened without hitch despite diffi-

culties as the three days before the opening were national holidays. The National Theater, in which the exhibition was held, was specially decorated and had a pleasing appearance. Music throughout the week was furnished by a government band. Total attendance for the week was 6,900, the best day being the closing Sunday when the visitors numbered 1850.

The total sales were 62 low-priced cars, 64 of the medium price class and 26 of the high priced class. Five trucks and ten tractors were sold. Eighteen passenger cars, two truck and four tractor lines were shown. The actual business done during the show was 800,000 pesos, with many prospects not yet closed.

Dealers say the show this year was better than that of last year and are surprised at the results. President Obregon attended on Saturday morning.

Moline Plow Reorganizes As Virginia Corporation

RICHMOND, VA., April 26—The Moline Plow Co., Inc., has been incorporated under the laws of Virginia as a reorganization of the Illinois company. It has an authorized capital of \$20,000,000 in preferred and 200,000 shares of common.

The Moline Plow Co., which is controlled by the Willys-Overland company through the ownership of 82 per cent of the common stock, was incorporated in Illinois in 1870 and was gradually expanded until it became one of the largest producers of agricultural implements, wagons, trucks, tractors and sleighs. Control passed to the Willys-Overland company in September, 1918, when it acquired the Stephens interest. The company encountered financial difficulties because of the financial depression, and the reorganization plan has been worked out by committees representing all classes of creditors and stockholders. The reincorporation came almost simultaneously with the acceptance by Willys-Overland stockholders of the reorganization plan.

U. S. Chamber to Discuss Highway Transportation

NEW YORK, April 26—Tentative approval has been given by the Chamber of Commerce of the United States to a group meeting for the discussion of highway transport at its annual convention in Washington in May. A. J. Brosseau, president of Mack Trucks, Inc., has been named as chairman of the division. Prominent speakers will discuss the economic foundation of highway transport, regulation, state programs and other relevant subjects.

The national counsellors of the chamber will meet May 15, the day preceding the opening of the convention, to act upon nominations for the board of directors. Among those nominated is W. O. Rutherford, vice-president of the B. F. Goodrich Co.

The United States Chamber of Commerce has received and has approved the discussion of resolutions on taxation, highway transport and anti-dumping which have been submitted by the National Automobile Chamber of Commerce.

New York Expects Good Summer Trade

April Will Exceed March, Which Was Record Month—Deliveries Heavy

NEW YORK, April 27—There is no doubt that passenger car sales in the metropolitan district, when finally tallied for April, will exceed the March record, which was the largest since the spring of 1920. May business also is bound to be good, and the most conservative distributors look for a continuance of spring sales conditions up to the end of June. They hardly expect May to be as big a selling month as April, and they look for a logical seasonal falling off in June. Early indications are for a normal summer business, with the prospects for fall dependent upon the general trend of business.

Sales records of one or two of the most popular cars will probably fall off a little in April from what they were in March. This condition is due to inability to make immediate deliveries, particularly of closed cars. Buyers in March, in most cases, were willing to wait for April delivery, but a good many April buyers showed a decided disinclination to wait until May for their cars.

Gain in Deliveries Big

Deliveries in April have been heavy, virtually all dealers running 25 per cent ahead of March and others 40 per cent more. The new car registration report for April will show a big gain over March.

In New York City April buying has lacked the "snap" which prevailed in March. March was an exceptionally mild month, and the urge to get out in the open sent thousands of people to the salesrooms eager to obtain new cars. April weather has been cold and generally wet, and buying has been built more on sales activities of the metropolitan staffs than on the spontaneous desire of buyers. Outside New York City itself, however, March did not show any such momentum.

Wizard Automobile Co. Assets Sold for \$105,500

CHARLOTTE, N. C., April 25—The final chapter in the career of the Wizard Automobile Co. was written yesterday when the entire assets of that company were sold by J. Lee Phillips to the Automatic Car Step Co. for \$105,500. The Wizard company was organized for the purpose of manufacturing the Wizard Junior automobile, to sell for \$395.

The sale was made subject to a higher bid within thirty days. The assets include one large building, several smaller ones and all the accessory machinery used in the manufacture of the automobiles, and 92 acres of land. All of the buildings are of the most modern type of construction.

Masetti in Mercedes Wins Sicilian Contest

**Averages 39.2 Miles an Hour and
Beats the Record He Made
Last Year**

PALERMO, SICILY, April 4 (*by mail*)—Driving a 300 cubic inch racing Mercedes of 1914 design with modern refinements, Count Masetti, an Italian amateur, won the thirteenth Targa Florio race 'round the island of Sicily. He averaged 39.2 miles an hour for the 269 miles of the race, beating his own record of a year ago, when he won this race on a Fiat, by 34 min. 15 sec.

There was unusual competition this year, for in addition to Count Masetti's German Mercedes, the Mercedes company of Stuttgart sent six other cars driven by their best professionals. Ballot put in a couple of machines with Goux and Foresti as drivers, Fiat had four cars, Austro-Daimler four, and others were Itala, Alfa-Romeo and Ceirano, making a total of 44 starters. Of these 26 finished.

Supercharger Appears in Races

Much technical interest attached to the entries, for several of them were new racers which will be seen in the European events. For the first time in Europe a supercharger was used on two six cylinder Mercedes cars of 4.1 by 5.5 ins. bore and stroke, driven by Sailer and Werner, and by two new four cylinder Mercedes cars of 2.5 by 4.4 handled by Minoia and Scheef. It was difficult to judge the value of the Mercedes supercharger in the race for the reason that, owing to the nature of the course, it was not possible to keep the charger in operation for more than a portion of the time.

All four cars with superchargers were stated to be stock models, of a high speed sporting type. The small ones are entirely new and will be used by Mercedes in the various races to be held in Europe this season. Cylinder construction is steel, with a common water jacket for the four cylinders. There are four valves per cylinder with a couple of overhead camshafts, the drive for which is by vertical shaft and bevel gearing at the rear. The compressor is at the front, driven off the crankshaft. These little racing cars have shaft drive and cantilever rear springs, the rear portion of the spring being much shorter than the forward portion. Front wheel brakes are fitted.

Fiat to Produce Racing Car

Fiat's best machine in the race was the four cylinder 91 cubic inch model, driven by Giacconi. This car is going into production on a small scale as a special high speed sporting type. The little engine of 2.5 by 4.4 ins. bore and stroke develops better than 65 hp. at 5000 revolutions and has steel cylinders with a common welded-on water jacket for the group. Two valves per cylinder

are employed with a couple of overhead camshafts operating the cams through a light follower. A feature of the engine is the use of roller bearings for every part except the wrist pins. Crank case is dry, all the oil being fed from a dash-board tank and returned to this tank by a scavenging pump.

Austro-Daimler competed with the smallest cars, four cylinder models of only 2.7 by 2.9 ins. bore and stroke, having a piston displacement inside 67 inches. The engines have aluminum cylinders with steel liners, a detachable head and two overhead valves per cylinder. Camshaft drive is from the front end, by a vertical shaft and bevel gearing, with the electric generator on the shaft itself. These little cars have rear cantilever springs and front wheel brakes. One of the features of the race was the use of brakes on the front wheels by practically everybody.

FINANCIAL NOTES

Stewart Warner Speedometer Corp. has declared a quarterly dividend of 75 cents a share on its stock, payable on May 15 to stockholders of record April 29, thus increasing the annual rate from \$2 to \$3 a share. The corporation paid 6 per cent in dividends 1917 and 1918, 9 per cent in 1919, 4 per cent in 1920 and the rate was further reduced on May 15, 1921 to 50 cents a share quarterly, at which payments were maintained until the present increase. Net profits of the corporation for the first quarter of 1922, not including income taxes, were \$516,000 against \$51,000 for the corresponding period last year.

Curtiss Aeroplane & Motor Corp. for 1921 reports gross profits on sales of \$578,118, and net profits, after all selling expenses and subsidiary company losses, of \$277,466. After allowing for interest charges, depreciation, etc., there was a net surplus for the year of \$101,207. The balance sheet at the close of the year showed a profit and loss deficit of \$1,158,924.

Pierce-Arrow Motor Car Co. for the first three months of 1922 shows an operating income after expenses of \$290,075, against a loss of \$160,193 in the same period of 1921. Deficit after taxes was \$25,226, as compared with a deficit of \$489,501 in the same period of 1921.

Republic Rubber Corp. showed its first net profit under C. H. Booth, the receiver, in March. After interest and all charges, the net was \$27,000. Shipments for the month were \$475,000. Based on gains to date, it is expected they will approximate \$550,000 in April.

Lee Tire & Rubber Co. has declared a regular quarterly dividend of 50 cents a share on capital stock, payable June 1 to stock of record May 15.

FRENCH GET BRITISH LICENSE

BRISTOL, ENGLAND, April 12 (*by mail*)—The Bristol Aeroplane Co., Ltd., has granted the sole license to manufacture in France the 400 horsepower Bristol Jupiter radial air-cooled aero engine to the Gnome & LeRhône Engine Co. This is said to be the first time the manufacturing license for an airplane engine of British design ever has been acquired by a French manufacturer.

BANK CREDITS

Written exclusively for AUTOMOTIVE INDUSTRIES by the Guaranty Trust Co., second largest bank in America.

During the last week the local money market was decidedly easy. Call money practically ruled at 3½ per cent for the whole week, the range being from 3½ per cent to 4 per cent, as compared with a range of 4 per cent to 4½ per cent in the previous week. On Monday renewals were put through at 4 per cent, while a flat rate of 3½ per cent was quoted for the rest of the week. In time money the situation in general was quiet, although funds were in large supply. Toward the end of the week all periods from 60 days to 5 months were quoted at 4½ per cent with 6 months at 4¾ per cent to 4½ per cent, as compared with 4½ per cent in the previous week for all maturities. The prime commercial rate was down to 4½ per cent, as compared with a range of 4½ per cent to 4¾ per cent in the previous week.

The Federal Reserve statement as of April 19 showed increases of \$5,186,000 in gold reserves and \$7,642,000 in total reserves. Bills on hand declined \$27,041,000 and total earning assets showed a shrinkage of \$7,866,000. Total deposits increased \$49,829,000, while Federal Reserve notes in circulation decreased \$19,215,000. The reserve ratio declined from 77.7 per cent to 77.3 per cent.

It appears that the coal strike now in its third week is having greater influence upon iron and steel conditions than was at first anticipated in some quarters. Although the rate of output is not greatly reduced, rising prices for pig iron and stiffening markets for steel are noted. The demand appears to be stimulated by less confidence in the adequacy of the fuel supply on hand.

According to reports filed with the Interstate Commerce Commission, the Class I railroads showed a net operating income for February of more than \$47,000,000, as compared with a net operating income of over \$29,000,000 in January and with an operating deficit of over \$5,000,000 in February, 1921. The net operating income for February, 1922, represents earnings at an annual rate of 4.57 per cent on the tentative valuation of the roads as fixed by the Interstate Commerce Commission. The income falls short by \$14,884,000 of the amount necessary to give an annual rate of return of 6 per cent.

JOHN LAUSON DIES

MILWAUKEE, April 21—John Lauson, founder and president of the John Lauson Manufacturing Co., New Holstein, Wis., a large manufacturer of gas engines and power farming equipment, died at Milwaukee Hospital following an operation. He was 54 years of age and established the nucleus of the present business when he was 19 years of age by opening a small machine shop to make gas engines and do repair work. Lauson designed the Lauson tractor.

INDUSTRIAL NOTES

Hayes Pump & Planter Co. control under the completed refinancing plans has been returned to the directors, newly elected. Officers of the company now are E. L. Yocum, president; R. W. E. Hayes, vice-president and secretary; A. L. Hayes, vice-president; F. H. Hand, treasurer and general manager. W. L. Jacoby, Chicago, president of the Mitchell Motors Co., Racine, Wis., is also member of the directorate. E. M. Kerwin has been controller of the company during the year, since creditors assumed management. The company is located at Galva, Ill.

Bingham Manufacturing Co., Columbus, has been organized with the election of H. N. Bingham, president and general manager; F. E. Kocher, vice-president and G. P. Hinkle, secretary. The company will manufacture rear transmission systems for motor trucks, assemble motor trucks and manufacture special bodies for trucks. The company recently acquired the property in this city of the Immel Co. and has come into possession of a plant at Hamilton, Ont., to manufacture for the Canadian trade, this latter company being known as the Triumph Motor Equipment Co.

Four Drive Tractors, Ltd., has bought the Four Drive Tractor Co., Big Rapids, Mich., and while it intends to continue the present size of tractor this year it plans to bring out two new sizes for 1923 trade. To take care of the new models, the plant facilities will be greatly increased. The new firm is a close concern with no outstanding stock or other obligations and is composed of A. V. Van Horn, manager; Emmet Deady, chief engineer; Henry Polaski, assistant manager; Arthur Martz, treasurer and Leon D. Williams, cashier.

Knox Tire & Rubber Co. at its reorganization meeting elected Judge F. O. Levering of Mt. Vernon, Ohio, president; Harker M. Lybarger, Mt. Vernon, first vice-president; J. O. Robson, Barton, Ohio, second vice-president and sales manager; F. D. Spencer of Mt. Vernon, secretary and George H. Jones of Mt. Vernon, treasurer. They constitute the board of directors together with C. F. Vandervert, J. P. Robson, George W. Ball, W. E. Johnson, G. L. Stephan, M. G. Spencer and Ezra Turner.

Wayne Oil Tank & Pump Co., Fort Wayne, Ind., announces the change of its name to **Wayne Tank & Pump Co.** The change was found advisable in view of the recent purchase of the Borromite Co. of America by the Wayne Oil Tank & Pump Co. The Borromite Co. formerly controlled the patent rights and sold Borromite water softening systems. These will be marketed hereafter under the name Wayne Water Softening Systems.

Six Wheel Truck Co., Fox Lake, Wis., will relocate in Waupun, Wis., local capital having assured a sufficient absorption of the stock and made provision for factory quarters so that quantity production may be started without delay. F. N. Pettigrew, president, and D. G. Strobel, sales manager, are moving their headquarters to Waupun and only a few details remain to be arranged to bring about the actual removal of the present plant.

Halliday Motors Co. has been appraised at \$103,000 by J. M. Spillman, B. L. Montgomery and M. J. Reese, appraisers in the suit brought against the company by the Barber Asphalt Co. The appraisement covers property in Seneca, Muskingum and Hocking counties, mostly real estate, and personal

property in Licking county. A supplementary appraisement is recommended.

Sandow Motor Truck Co. assets have been sold at auction in Chicago by the trustee. The property was purchased by various bidders, the good will and some of the machinery going to the Giant Truck Co. of Chicago Heights, Ill. The sale was for the purpose of liquidating the Sandow company and the trustee estimated that creditors would receive about 50 cent on the dollar.

Trumbull Tire & Rubber Co., plant at Newton Falls, Ohio, has been sold to the Union Savings & Trust Co. of Warren for \$130,000. The sale came as the result of a suit started in 1920 by the Stambaugh Co. of Youngstown whose officials claimed they had completed the plant at a cost of \$125,000 and part of this was unpaid.

Driver - Harris Co., manufacturer of Nichrome products with a plant at Harrison, N. J., announces that beginning May 1 its Chicago branch will occupy enlarged quarters at 562-574 West Randolph Street, that city. The facilities heretofore offered have been inadequate for its rapidly growing business in the Mid-West.

Canton Rim Co. has bought the property of the F. R. Fortune Tool Co. at Wooster, Ohio, for \$25,300. Of this \$13,000 was cash and the balance in preferred stock. The company will begin operations within sixty days and at the start will employ 25 to 30 men.

John E. Moore, general sales manager, and **William A. Kent**, eastern sales manager of the Hinckley-Myers Co., Jackson, manufacturers of complete garage and service equipment, have opened an eastern sales and executive office in the General Motors Building, Detroit.

Ralph Root has purchased the assets of the Worcester Abrasive Co., New York, manufacturer of "pep" water mixed valve grinding compound and has organized the **Pep Manufacturing Co.**, with offices at 33 West Forty-second Street, New York.

International Harvester Co. shipped from Jan. 1 to April 1 a total of 1,651 carloads of trucks from its factories at Akron and Springfield, Ohio. Of the total, 892 carloads were shipped west of the Mississippi river and 759 east of the Mississippi river.

Traylor Engineering & Manufacturing Co. first mortgage 8 per cent sinking fund bonds due June 1, 1936, to the amount of \$800,000 are being offered through H. D. Robbins & Co., New York, at 101 and interest.

United States Rubber Co. branch at Kansas City will become the largest of the 43 American branches of the company through the acquisition of a lease on an eight story building in that city.

New Engine for Airplane Still Under Development

WASHINGTON, April 24—The National Advisory Committee for Aeronautics, an independent bureau of the Government doing research on motor construction, has been informed of the progress made in developing the semi-Diesal airplane engine, on which the committee has been working for some time. Until the engine is fully developed and all plans have been completed, none of the specifications will be given out, Chairman Charles D. Walcott has announced.

The possibilities of an airplane engine, so constructed that it will run on a distillate, thus obviating the greater amount of danger from airplane fires, it was stated, are extremely favorable and will eventually be a reality.

METAL MARKETS

BOTH the pig iron and steel markets have responded with alacrity to the pranks and capers of frightened buyers, some of whom have apparently become so scared that they are placing orders without even mentioning the subject of prices. Thanks to the abject fear of the nervous contingent that they might be caught without sufficient supplies to satisfy their requirements the iron and steel markets have turned from the easy position they were in a few weeks ago into a strictly sellers' affair. There was a meeting of independent steel interests in New York a few days ago. Of course, no one knows what took place at this meeting, but the very fact that such a meeting was held proves the return of sunshine where a few months ago there were only great glooms of gloom.

Youngstown sheet producers let it be understood that they doubt whether consumers will be given an opportunity to cover their requirements at prevailing levels should a further advance in sheet prices be generally decided upon. This advance is already in the making. Some of the mills mention 3.30@3.40c for black and 4.30@4.40c. for galvanized as asking prices on new business. They have not yet booked any business at these prices, which imply an advance of \$3@5 a ton, but there is no telling what may come to pass in a market such as the present one.

Full-finished automobile sheets are quoted at 4.50c. It is only natural that, with the production of most sheet mills engaged up to June 30 at prices \$6 a ton below what many producers believe they could obtain to-day, there is no eagerness for orders for third quarter deliveries. In spite of all the nervousness which many smaller consumers manifest, there is very little danger of runaway market conditions. In the first place, large buyers are looking upon recent developments in the iron and steel markets with considerable equanimity. They have covered their requirements for the current quarter and can afford to assume a waiting attitude. In the second place, the chief steel producing interest's policy has never been more conservative. It aims at the building up of a sound backlog of orders at present prices and a stabilization of the market. The independents can go just so far in the matter of prices and no further.

Pig Iron.—More and more furnaces are going into blast. Prices are \$2 higher than they were a month ago. A further price flurry is not precluded, but with increased production and a sane attitude on the part of buyers it should be short-lived, especially if the coal strike is settled in the near future.

Steel.—Automotive consumers have placed orders (in some instances for as much as 1000 tons) for hot- and cold-rolled strip steel, with the result that many producers are reluctant to commit themselves beyond the present quarter. Cold-rolled is steady at 3.65c. and hot-rolled at 2c., Pittsburgh. Prices for nuts and bolts have been revised upwards. For sheet bars as high as \$35 is asked, although in some instances business for deferred shipment has been placed at \$31@32.

Aluminum.—Market has turned stronger and it takes some combing to uncover 98 to 99 per cent pure virgin ingots at below 18c. Automotive consumers are in some instances specifying on contracts ahead of the maturing of deliveries.

Copper.—The market for ingot metal is of a lackadaisical character. The leading rolling mills interest has reduced all copper products, with the exception of wire and wire rods, 1c. per lb., and all brass and bronze products ½c. a lb.

Calendar

SHOWS

Nov. 13-18—Chicago, Annual Show and Meeting of the Automotive Equipment Association.

FOREIGN SHOWS

March 10-July 31—Tokio, Japan, Peace Exhibition.
April 22-May 1—Prague, Czechoslovakia, Fourteenth International Automobile Exhibition.
May—Shanghai, Exhibition of Road Building Material.
May, 1922—Quito, Ecuador, Agricultural Exposition, celebrating Centenary of Ecuador. Automotive Section.
May 1-15—The Hague, Automobile Show, also Airplanes and Motorboats. Secretary, Spui 185, The Hague.
May 6-21—Scheveningen, Automobile Show.
May 24-June 5—Barcelona, Spain, Automobile Show under Dealers' Direction.
May. 28-June 5—Prague, Motor Show. Hotel de Ville.
July 1-24—London (Olympia). Aircraft Exhibition.

Sept. 1922—Rio de Janeiro, Brazil, Automobile exhibition in connection with the Brazilian Centenary Association Automobilista Brasileira.
Sept. 15-20—The Hague, Automobile Show.
September—Buenos Aires, Argentina, Annual Exhibition, Sociedad Rural Argentina.
Oct. 4-15—Paris, Automobile Show, Grand Palais.
Oct. 12-23—London (Olympia). International Commercial Vehicle Exhibition.
Nov. 3-11—London (Olympia). Automobile Show.
Nov. 10-Dec. 19—Brussels, Automobile Show, Palais de la Cinquantenaire.
Nov. 29-Dec. 4—London (Olympia). Cycle and Motorcycle Show, British Cycle Motors, The Tower, Warwick Road, Coventry.
November—Buenos Aires, Argentina, Annual Exhibition, Automovil Club Argentino.

RACES

May 31—Indianapolis International Sweepstakes.

CONVENTIONS

May 8-10—New York, National Association of Manufacturers.
May 10-12—Philadelphia, Ninth National Foreign Trade Convention of the National Foreign Trade Council.
May 12—New York, Annual Meeting, National Highway Traffic Association, at the Automobile Club of America.
May 16-17—Detroit, Semi-Annual Convention, Factory Service Managers, National Automobile Chamber of Commerce, Hotel Statler.
May 16-18—Washington, D. C., Annual Meeting of the Chamber of Commerce of the United States.
May 22-23—St. Louis, Annual Meeting of the American Automobile Association.
May 22-25—New York, Palisades Interstate Park, Second National Conference on State Parks, Bear Mountain Inn.
June 11-15—Milwaukee, Annual International Convention

of the Associated Advertising Clubs of the World.
June 19-20—Detroit, Summer Convention of the Automobile Body Builders Association.
June 19-24—Colorado Springs, Summer Meeting, Automotive Equipment Association.
June 26-July 1—Atlantic City, Twenty-fifth Annual Meeting of the American Society for Testing Materials, Chalfonte-Haddon Hall Hotel.
August 28-Sept. 2—Detroit, National Safety Congress.
Sept. 18-23, 1922—Rome, Italy, Second Annual Meeting of the International Chamber of Commerce.
S. A. E. MEETINGS
June 20-24—White Sulphur Springs, W. Va., 1922 Summer meeting of Society of Automotive Engineers.
Indianapolis, May 8; Chicago, May 12; Detroit, May 19. The Pennsylvania section will hold an outing at Torresdale or a body meeting on May 25.

Reo Selects Windsor for Canadian Plant

DETROIT, April 25—The Reo Motor Car Co. has taken over the plant of the Swedish Crucible Steel Corp. in Windsor and will locate its Canadian manufacturing branch there. The work of moving equipment from the former St. Catharines plant is now under way; D. B. McCoy, former advertising manager of the company, has been appointed manager of the Canadian branch.

The plant will be used exclusively for production of Reo cars and speed-wagons for the Canadian trade, the general export business of the company to be continued from the Lansing plant. Assembling of vehicles will be under way within 90 days, and it is expected to reach a production, with facilities to be added, of 15 to 20 daily.

The St. Catharines plant of the company has not been in operation for about four years. Some time ago it was determined to move the Canadian branch to Windsor as the logical site for motor car manufacturing in that country. Plans were held up pending the acquisition of suitable buildings. The Canadian offices of the company will be located in Windsor after May 1.

Factories in Detroit Short of Skilled Labor

DETROIT, April 24—Increased production in automotive plants has absorbed practically the entire supply of skilled labor in this district. Some factories are having difficulty in obtaining common labor. An actual shortage of skilled workmen is reported in body plants. Many advertisements for wood working, machine and other skilled op-

eratives are being carried by Detroit newspapers.

An increase of 4500 men on the payrolls of members of the Employers Association was reported last week, bringing the total to 145,234, or within 50,000 of the peak in 1920.

TRACTOR PRICES REVISED

NEW YORK, April 24—Price revisions have been announced by the different manufacturing companies on the following tractors:

	Old Price	New Price
Helder C	\$900	\$995
Townsend, 10-20	750	800
Fitch .....	...	1,850
Mohawk	785	650
T. B.	715	500
International, 15-30	1,500	1,750
Reliable, 10-20	865	390

SMALLER TRACTORS SELLING

LOS ANGELES, April 22—Tractor dealers in Los Angeles and other cities in Southern California report that there has been a satisfactory movement of the small, lower-priced lines this spring.

DIAMOND NAME PROTECTOR

WASHINGTON, April 27—The Federal Trade Commission has issued an order prohibiting the Diamond Holdfast Rubber Co. of Atlanta from using the word "Diamond" in connection with the rubber business as this word has been established in the rubber trade by the Diamond Rubber Co. of Akron, Ohio, which began its use in 1898. The commission's order not only prohibits the Atlanta company from using the word "Diamond" but also from the use of the figure of the diamond or any symbol or mark likely to be confused with it.

Dominion Steel Elects Jones Head

DETROIT, April 26—Harry Ross Jones, president of the United Alloy Steel Corp., Canton, Ohio, has been elected chairman of the board of directors of the New Dominion Alloy Steel Corp. W. B. Boyd of Toronto was made president and George A. Simpson of Hamilton and B. H. McCreath of Toronto were elected vice-presidents.

A large site fronting on the St. Claire River in the south end of Sarnia has been ceded to the company by the Canadian government. Construction of a plant is expected to be started in six weeks. The first unit will probably be in operation in twelve months.

The company will specialize in production of hardened automobile steel, of which about \$5,000,000 worth is imported into Canada annually. The company is to have an authorized capital stock of \$15,000,000. Five million dollars will be subscribed for the commencement of operations. Arrangements are reported to have been made with bankers to underwrite the stock issue.

Kelsey Wheel to Make Bodies for New Gray

DETROIT, April 26—The Kelsey Wheel Co., Inc., will make the bodies for the new Gray motor cars, in both open and closed models. Until within the past year, Kelsey was a big producer of Ford bodies, having a capacity for over 1000 bodies daily. This work was discontinued with the opening by the Ford company of its own body making plant.

First bodies for the Gray line are now under construction in the Kirby Avenue plant of the Kelsey company.

AUTOMOTIVE INDUSTRIES

The AUTOMOBILE

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Three dollars a year



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Tapered
ROLLER BEARINGS *at ALL speeds*
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*Largest Manufacturers of Automobile
Body Hardware in the World*

SO completely does Ternstedt Automobile Body Hardware respond to the exacting demands of installation and service, it is today standard equipment in most of the better built motor car bodies, *exclusive* equipment in many.

The Ternstedt line includes dependable and correctly designed appliances for every requirement, from which complete outfits for any type of body may be selected.

Those interested in the building of better bodies will find in Ternstedt an organization with more than ordinary facilities, both in men and equipment, for the intelligent production of fine body hardware.

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WINDOW REGULATORS :	CUR-	PIANO HINGES :	REAR DECK
TAIN ROLLERS :	SUNSHADES :	HINGES :	REAR DECK LOCKS :
OPEN AND CLOSED BODY DOOR		REAR DECK LID BRACES :	CHAN-
LOCKS :	DOOR PANELS :	NEL AND SHAPES :	SCREW MA-
BUMPERS :	ANTI-RATTLERS :	CHINE PRODUCTS :	DIE CAST-
WINDSHIELDS :	WINDSHIELD	INGS :	ALL KINDS OF STAMP-
WIPERS :	WINDOW SASH :	INGS :	OTHER MISCELLANEOUS
HINGES :	CONCEALED HINGES :	AUTOMOBILE BODY HARDWARE	



AUTOMOTIVE INDUSTRIES

The AUTOMOBILE

Vol. XLVI
Number 11

PUBLISHED WEEKLY AT 239 WEST 39th STREET
NEW YORK, MARCH 16, 1922

Thirty-five cents a copy
Three dollars a year



The Average Buyer Demands More For His Money

The trend of the day is toward "fours" because the buyers of medium priced cars go about their buying more intelligently than before and demand better car value.

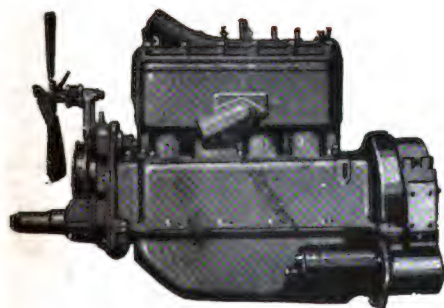
They know, now, that a good "four cylinder" motor provides ample power and flexibility and that its economy of operation and upkeep is a factor too great to be ignored.

They realize—too—that in the "four" they get better body design, added "comfort facilities" and more all-round car goodness—things that must be skimped in the multi cylindered car of the same price.

Thus—the Lycoming, the highly developed product of manufacturers of "fours" exclusively, comes to its own.

Write for the Lycoming hand book of facts.

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MOTOR



See How the Patented Centrifugal Force Process Makes the Linings in Federal Bearings Absolutely Uniform

Note the Wonderfully Close Grain, the Fine, Even Crystallization and the Uniform Texture

THESE microphotographs (enlarged 100 diameters) show the physical difference between bearings lined by usual methods—and Federal Bearings, lined by our Centrifugal Force Process.

Engineers say that this Centrifugal Force Process—by which bearings are lined under the pressure of centrifugal force at 3250 R.P.M.—is the greatest single forward step in the history of the Bearing Industry.

The Centrifugal Force Process automatically controls the rapidity of cooling. Each bearing is lined in exactly so many seconds and the cooling is always in exactly the same ratio to the lining process. Thus every Federal Bearing Lining is uniform in texture, remarkably close grained and extremely tough. It will not flake off. Because of the purely mechanical nature of the process there is never any variation—and every Federal Bearing is exactly like all other Federal Bearings.

Another special advantage of Federal Bearings is the fact that the linings adhere to the backs throughout the whole life of the bearing—first, because the bonding alloy is at the correct temperature during the lining process, and second, because the Babbitt Metal is distributed by centrifugal force under great pressure with absolute uniformity over the whole surface of the back.

You need Federal Bearings in your motor because they will greatly increase the life of the most wear-subjected parts, and thus add to the reputation of your motor for stamina. Write for complete details about the Centrifugal Force Process. Learn how it insures absolute uniformity in every Federal Bearing.

This Shows Why Federal Bearings Wear Longer

MICROPHOTOGRAPH of the Babbitt Lining of a Federal Bearing, enlarged 100 diameters. Compare this picture with the one shown below. See how wonderfully close the grain is in this Federal Bearing. Note the dense crystallization, the fine structure and the absolute uniformity of grain. Naturally this makes Federal Bearings tougher and better wearing. They last longer and have no weak spots.

This finer crystallization in the Babbitt Lining of Federal Bearings is due to the rapid rate of cooling—which prevents the large and uneven crystallization so noticeable in the bearing pictured below.



Note the Large Crystallization In This Bearing

MICROPHOTOGRAPH of a bearing used by a well-known automobile, enlarged 100 diameters. To the naked eye it looks like a good bearing. Undoubtedly the car manufacturer thinks it is a good bearing. But notice the large and uneven crystallization—which means a lining of varying character and one which wears unevenly. This large crystallization is due to the slow rate of cooling and to the unavoidable variation of pressure during the lining process. This picture graphically shows the physical and structural defects, which while not visible to the naked eye, do, nevertheless flake off and greatly shorten the life of such a bearing.

FEDERAL BEARING & BUSHING CORPORATION
BABBITT-LINED BRONZE-BACK BEARINGS - BRONZE BUSHINGS - BRONZE CASTINGS
DETROIT - MICHIGAN

X
M-27-22

AUTOMOTIVE INDUSTRIES

The AUTOMOBILE

Vol. XLVI
Number 12

PUBLISHED WEEKLY AT 239 WEST 39th STREET
NEW YORK, MARCH 23, 1922

Thirty-five cents a copy
Three dollars a year



Motor Wheel
PRODUCTS

WHEELS produced by Motor Wheel Corporation are an asset to the car or truck you make, because of the resources, experience and reputation involved in every step from standing timber to priming coat.

Motor Wheel Corporation, Lansing, Michigan

Motor Vehicle Wheels Complete — Metal Stampings — Steel Products
Gier TUARC and Gier LEWIS Steel Wheels for Passenger Cars

Waltham Speedometers and Automobile Clocks

The reputation of an automobile depends upon the service of its units

THE selection of the materials and equipment is as big a factor for durable and efficient service as the construction of the chassis.

The leading manufacturers such as Cunningham, Daniels, Fergus, Lafayette, Leach-Biltwell, Lincoln, Packard, Pierce-Arrow, Renault, Rolls-Royce, Stevens-Duryea, Wills-Sainte Claire, use Waltham speedometers as standard equipment.

A dependable and accurate speedometer is a necessity.

The Waltham speedometer is the only air-friction speedometer in the world. It was invented by Nikola Tesla and developed and perfected by the Waltham Watch Company — and is made to standards of precision unequalled in modern engineering.

The Waltham speedometer tells the exact speed of the car instantaneously.

Being an extraordinary invention, it is unaffected by climatic conditions. It is impervious to grease and dirt. It is a superlative instrument.

Manufacturers who only consider the best good enough for their equipment, always use Waltham speedometers and automobile clocks. That is why they are standard equipment on the world's best cars. A Waltham speedometer and automobile clock are a part of the owner's satisfaction.

Waltham Quality is within the reach of every manufacturer.

WALTHAM WATCH COMPANY
WALTHAM, MASS.

Service Stations in all leading cities

WALTHAM

The Speedometer of Instantaneous Accuracy



Model 1501



Model 410



Model 1102



Model 300



Special Model



Model K1



Special Model



Model R1



Model 1503

AUTOMOTIVE INDUSTRIES

The AUTOMOBILE

Vol. XLVI
Number 14

PUBLISHED WEEKLY AT 249 WEST 30th STREET
NEW YORK, MARCH 30, 1922

Thirty-five cents a copy
Three dollars a year

ATWATER KENT

Ignition, Starting and Lighting

TWENTY YEARS of continuous manufacturing experience has simply confirmed what we have always believed: That design, material and mere machinery is but a small part of such a highly organized electrical unit as an ignition system; that *the* biggest element is that *esprit de corps*, or organization, of master artisans—constantly impelled by pride of product to “make it better.”

The acknowledged perfection of Atwater Kent products reflects this *esprit de corps* in an unusual degree.

In design, manufacture, performance and durability, Atwater Kent products have evidenced their superiority.

Many of America's best cars are Atwater Kent equipped. Hundreds of thousands of satisfied owners testify to its efficiency.

ATWATER KENT MFG. COMPANY

Department A1

Philadelphia



The buyer's ideal car or truck is a genuine **SPECIALIZED** Vehicle

When the motorist or truck-user of today visualizes the type of car or truck that *he* would choose to build for his own use, he pictures a vehicle constructed of masterpiece units.

Experience has taught him a definite lesson. It has convinced him that the ideal type of car or truck must be what a genuine **SPECIALIZED** vehicle is today; namely, a vehicle built exclusively of *proven* units—a vehicle guaranteed by its builder, backed by the ability of the unit **SPECIALISTS** and adequately

protected by parts-distributing stations that dot the world.

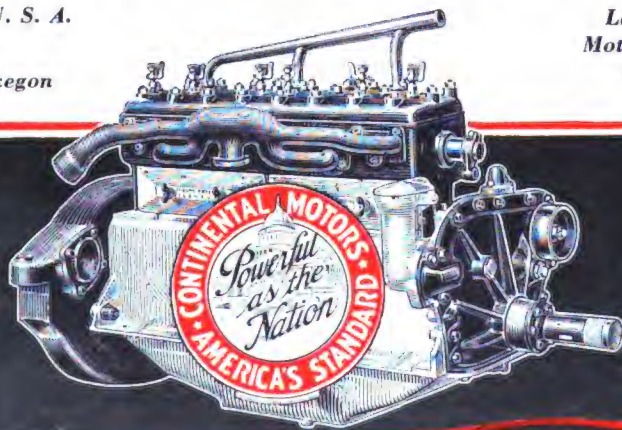
Farsighted dealers, therefore, are identifying their organizations with high-grade **SPECIALIZED** vehicles. They are insuring their own futures by capitalizing the growing demand for cars and trucks built exclusively of thoroughbred units—such units, for instance, as the motor that bears on its crankcase the foremost symbol of **SPECIALIZATION** — the Continental Red Seal.

CONTINENTAL MOTORS CORPORATION

Offices: Detroit, U. S. A.

Factories:
Detroit and Muskegon

Largest Exclusive
Motor Manufacturers
in the World



Continental Motors

RUSCO

Brake Lining for better brakes

RUSCO Brake Lining is solid woven. It contains no stitching or loose gutting threads to break or separate and cause rapid wear once the outer surface is gone. As the different layers wear off, the surface presented to the brake drums is always the same. Though it wears down to a sliver, it always has the same mighty grip.

Rusco Brake Lining contains only ten per cent of cotton by weight, which is the least possible amount necessary in order to spin the asbestos yarn. Spun in our own mills, by the way, in order to gain uniformity. We could not depend on yarns spun outside to produce our quality. I have seen an acetylene torch applied to Rusco Brake Lining and not injure it in the least.

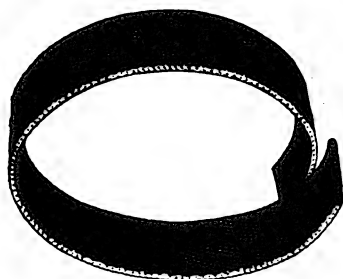
Clutch Facings for better clutches

RUSCO Clutch Facings are woven solid just as Rusco Brake Lining is. But the finished product contains no cotton whatever. It is one hundred per cent asbestos and brass wire with a certain amount of treatment.

This treatment is insoluble in boiling oil. Therefore, no matter how much friction heat is generated in the clutch this treatment never becomes sticky. "Freezing" or sticking in clutches is often caused by poor treatment, which oozes to the surface when heated.

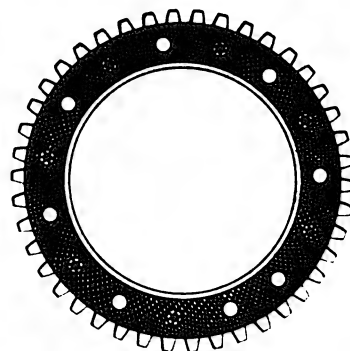
Rusco Clutch Facings are woven over size and compressed to the required thickness and hardness. Rivets may be countersunk properly.

Rusco Clutch Facings engage gently, hold tenaciously and release instantly at the wish of the operator.



THE
RUSSELL
MANUFACTURING
COMPANY

Middletown, Conn.



Rusco also makes these products

Rusco Hood Lacing

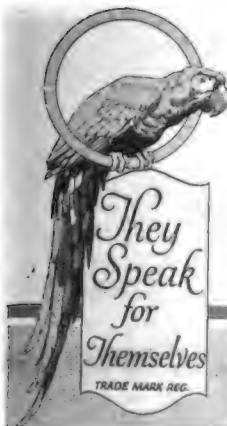
Rusco Fan Belts

Rusco Tire Straps

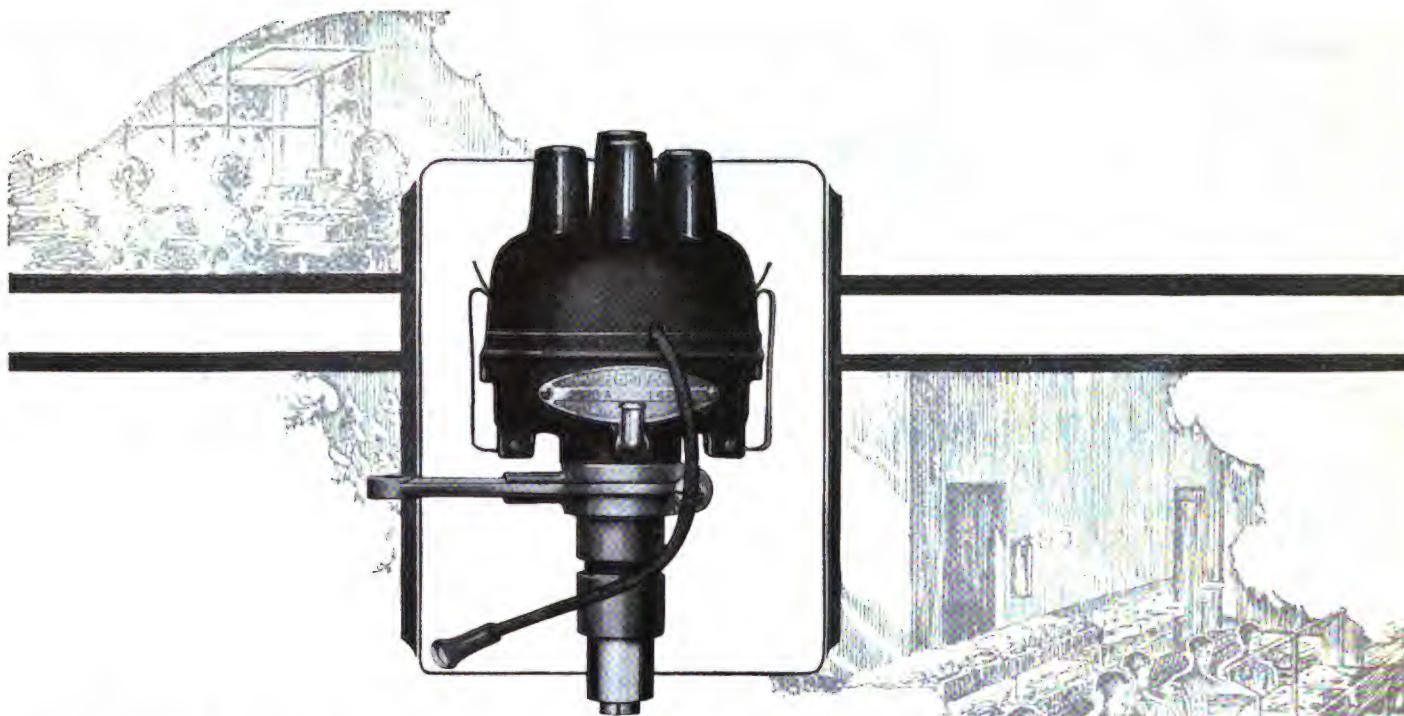
Rusco Tabbuckler Strap

Rusco Emergency Brake for Fords

Rusco Transmission Lining for Fords



RUSCO PRODUCTS



Since Eighteen Ninety Eight

It is only natural that Remy ignition should hold a dominant position today. The Remy Electric Company were pioneer manufacturers of ignition equipment and several of America's first cars were built with Remy systems.

The Industry's growth is the history of Remy's growth—a steady progress earned by diligent care of the requirements of car and truck builders.

And, just as the Industry continues to give Remy ignition due recognition year after year, so too is Remy starting and lighting equipment regularly used on many of the leading makes of cars and trucks today.

The Model 606 Semi-Automatic Distributor Illustrated Above is One of the Recent Developments in Remy Ignition.

REMY

STARTING LIGHTING IGNITION SYSTEMS

REMY ELECTRIC COMPANY

ANDERSON, INDIANA



AUTOMOTIVE INDUSTRIES

AUTOMOBILE

THE CLASS JOURNAL COMPANY
239 WEST 39th STREET NEW YORK CITY

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Main Office and Works at Worcester, Mass.

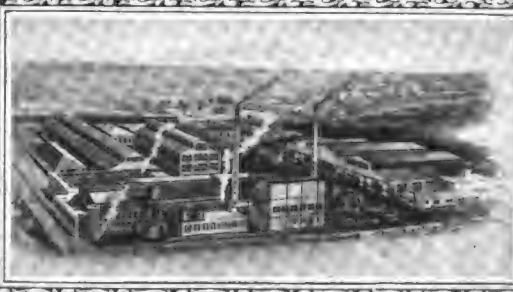
THIRTY-nine years of experience in forging practice has helped make the Wyman-Gordon Crankshaft the Standard of the Industry.

*There is no substitute for
Wyman-Gordon
Quality and Service*

WYMAN · GORDON
The CRANKSHAFT MAKERS
WORCESTER, MASS. CHICAGO, ILL. CLEVELAND, OHIO



Ingalls-Shepard Division at Harvey, Ill.





Every Push a Pull at Your Payroll!

Truckage—Money paid for the conveyance of goods on a truck.— Webster's Dictionary.

"Money paid." That's the point. Even the writer of a dictionary realized the constant expense of moving materials by hand labor. And the definition admits that the use of a truck does not eliminate the expense.

You can put gravity to work in your factory—services free! Dow Gravity Conveyors—supplemented where necessary by special units such as metal belts and automatic elevators and designed and built in many styles for particular requirements—are daily rendering efficient, almost free handling service in hundreds of busy businesses.

Materials, parts and finished products can be quickly, safely and cheaply moved from one operation to another—store room to shipping floor—factory to freight car—at an astonishing saving in time, labor and money.

Ask the nearest Dow engineer for details.

THE DOW CO.
LOUISVILLE, KY.

New York Office, 50 Church St.
Chicago Office, 1235 Old Colony Bldg.
Detroit Office, 8855 Woodward Ave.
Philadelphia Office, 1212 Arch St.
Pittsburgh Office, 245 4th Ave.
Rochester Office, 82 Conkey Ave.
Representatives in other principal cities.
Canadian Representatives, Jones & Glassco, Reg'd.,
Montreal and Toronto
Cuban Representative, J. H. Mitchell,
417 Manzana de Gomez, Havana

DOW
LOUISVILLE
CONVEYORS

IN the analysis of markets it is customary to accept many statistics without a thorough examination of the sources or the methods of calculation. Perhaps this is one reason for the rather widespread opinion that much market analysis from statistics is of limited value in connection with sales operations.

In the examination of marketing problems being conducted in the columns of *Automotive Industries*, the object has been to examine the methods of analyses so as to include the proper examination of the statistics and their application.

HARRY TIPPER.



They Know—

The boys in the thousands of repair shops where your car is serviced—they know that Laminated Shims are the standard bearing equipment throughout the industry.

LAMINUM

They know when you sacrifice a point in service to save a penny in cost. And they can often make or mar the reputation of your car with your owners and prospective buyers.

LAMINATED SHIM CO., INC.

11th St. & Governor Pl., Long Island City, N. Y.
Detroit: Dime Bank Building
St. Louis: Mazura Mfg. Co.
Chicago: 1118 S. Michigan Ave.

230 Ford Truck Rear Hubs

Finished in 9 Hours

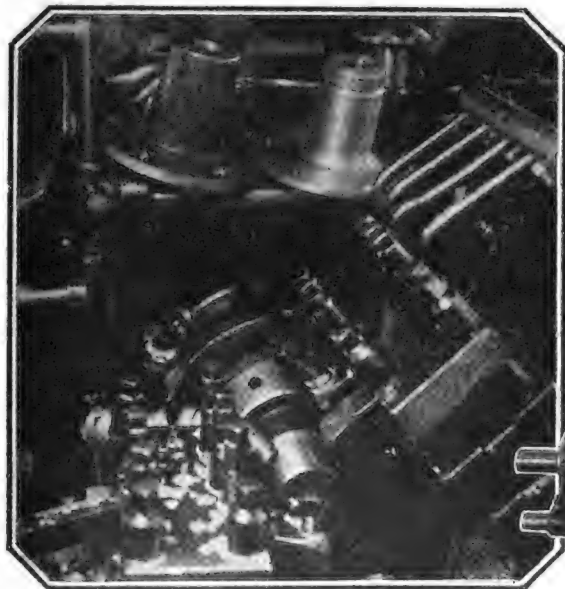
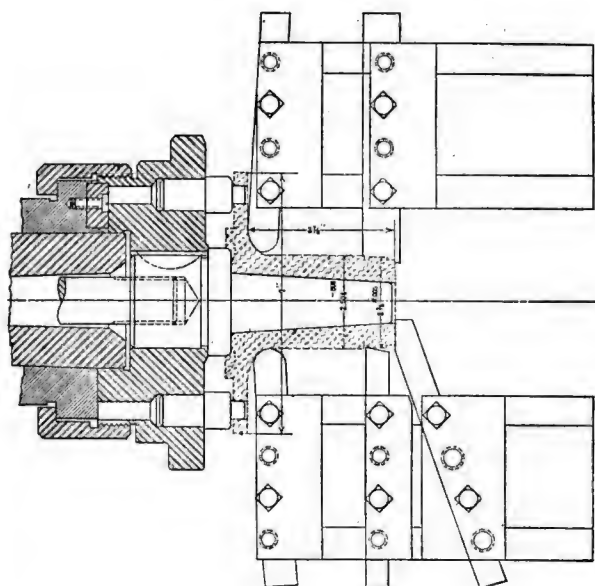
On Each Fay Automatic Lathe

These Hubs are finish turned in these machines from the rough forging, right down to the finished size in one cut. Each machine finishes 230 of these hubs in 9 hours.

**230 FINISHED HUBS PER MACHINE
IN 9 HOURS IN ONE CUT**

It makes no difference how much stock has to be removed on this job—one cut does the trick and holds the size. These forgings weighed up to $14\frac{1}{2}$ lbs. each when delivered to the Fay and $7\frac{1}{4}$ lbs. each after being turned as shown.

The Fay Way removes stock by the ton and yet holds the size!

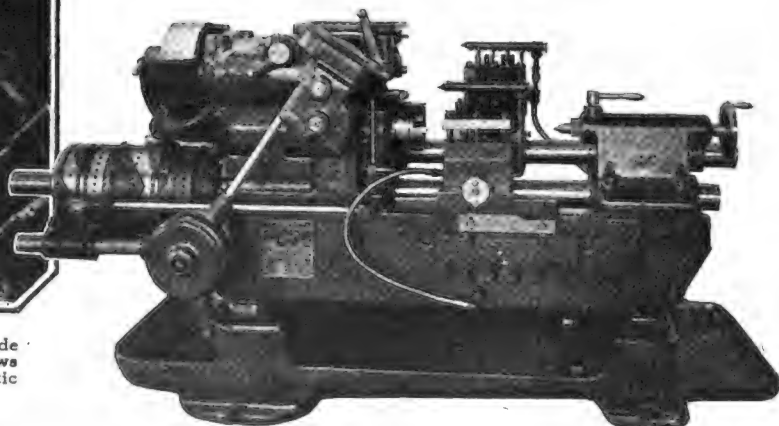


The above photograph was taken at the Riverside Machine Company, Jackson, Michigan, and shows a close up of one of a battery of Fay Automatic Lathes finish turning Ford Truck Rear Hubs.

Jones & Lamson Machine Co.
Springfield Vermont

503 Market St., SAN FRANCISCO, CAL.
9-10 Water Lane, Queen Victoria St., LONDON, ENG.

AGENTS: France, Spain & Belgium—F. Auberty & Co., 91 Rue de Mauberge, Paris; Holland—Spilthoff, Beeuwkes & Co., Rotterdam; Japan, Korea, etc.—Mitsui & Co., Ltd., Tokio; Australasia—McPherson's Pty., Ltd., 554 Collins St., Melbourne; Stockholm, Sweden—A. Bol Oscar Lindbom, Postbox 420.



FAY AUTOMATIC LATHE

SALISBURY
Axles for Passenger Cars

Sheldon
Axles for Motor Trucks

Sheldon
Springs for Motor Cars and Trucks

Spicer
Propeller Shaft

Parish
Heat Treated Frame

THE vital load-carrying parts of a motor car or truck must shoulder their share of the responsibility for the vehicle's performance.

Most of the motor vehicles that have become known for their ability to stand up, are using one or more of the units shown above.

Salisbury Axle Co.

Sheldon Axle and Spring Co.

Parish Mfg. Corp., Reading, Pa., and Detroit, Mich.

Spicer Mfg. Corporation

Jamestown, N. Y.

Wilkes-Barre, Pa.

South Plainfield, N. J.

C. A. DANA, *President*



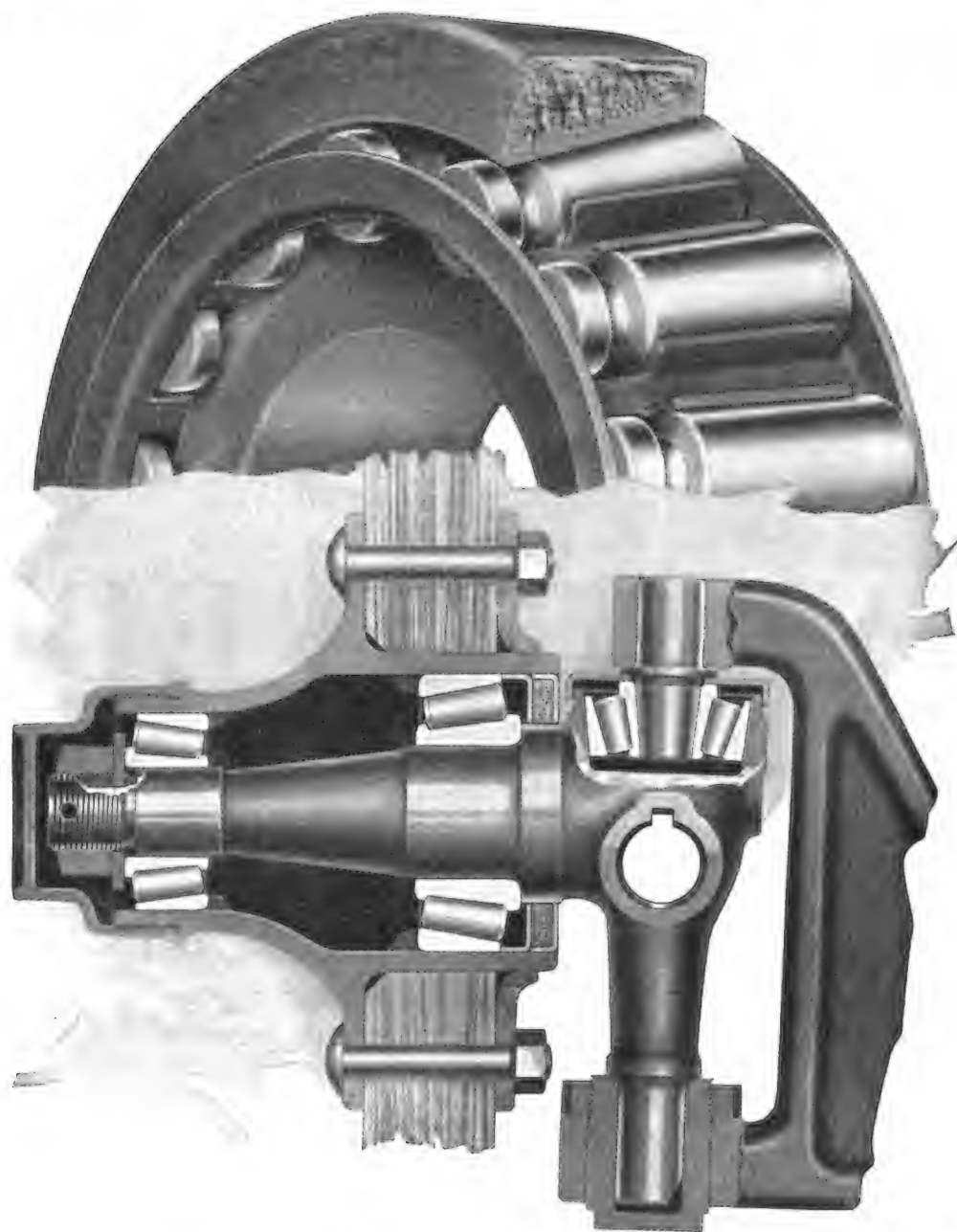
APPROVED

The Nagel Ammeter is now standard equipment on *three million* motor cars and trucks. These include more than fifty well-known makes, showing that automotive engineers quite generally rate the Nagel as the leader in its field and place the stamp of their approval on its dependability and its accuracy.

NAGEL AMMETER

 THE W.G. NAGEL ELECTRIC CO. 
TOLEDO OHIO

In Front



Timkens Are Used in the Front Wheels of these Cars and Trucks—

Acason	Bessemer	Couple Gear	Facto	Hebb	Kissel	Moon	Peerless	Selden	U S
Ace	Bethlehem	Crawford	Fageol	Hendrickson	Kleiber	Moreland	Piedmont	Seneca	
Acme	Betz	Crow-Elkhart	Federal	Holmes	Koehler	Murray	Pierce Arrow	Service	Velie
Advance- Rumely	Big Four	Cunningham	Ford	Hudson			Pierce	Signal	Victor
Ahrens-Fox	Bour-Davis		Ford Tr	Hupmobile	Lafayette	Napoleon	Arrow Tr	Singer	
All-American	Brewster	Daniels	Forster		Lang Truck	Nash	Premier	Southern Tr	Wachusett
Allison (W H)	Brinton	Dart	Fox	Independent	Lansden	National	Preston	Southern Tr	Walker
American	Brockway	Davis	Fulton	Independent	Lapeer	Nelson & Le Moon		Standard	Walker-Johnson
American	Buffalo	Dearborn		M T Co	Leach-Biltwell	Netco		Stephens	Waltham
Beauty		Dehance	Gardner	International	Liberty	New York	Rainier	Sterling	Ward La France
American- La France	Cadillac	Denby	Garford	Jordan	Lincoln	Noma	Reliance	Studebaker	Ward
Apex	Case	Dependable	Gary	Jumbo	Locomobile Tr		Reo Tr	Sullivan	Watson
Apperson	Chandler	Detroit Elec	Gottfriedson	Kalamazoo	Lorain	O'Connell	Republic	Superior	Westcott
Armleder	Chevrolet Tr	Detroit Motor	G M C	Motors	Luedinghaus	Ogden	Riddle Coach		White Hickory
Atlas	Chicago	Diamond T	Geronimo	Kankakee		Oklaoma	Roamer	Tarkington	Wilson
Atterbury	Cleveland	Dixie Flyer	G W W	Auto	Maccar	Overland	Ruggles	Texas	Winther
Auburn	Clinton	Doane	Giant	Kearns	Mack		R & V Knight	Three Point	Winton
Autocar	Clydesdale	Dodge	Graham	Kelly- Springfield	Maibohm	Packard		Titan	Wisconsin
Available	Collier	Dort	Brothers	Keystone	Marmon	Packard Tr	Sandow	Tower	Witt-Will
	Columbia	Dorris	Hahn	Key-tone	Master	Paige	Saxon	Traffic	
Baker R & I.	Columbia Tr	Douglas	Hall	Vehicle Co	Maxwell	Pan-American	Sayers	Transport	
Beck	Commerce	Durant	Handley- Knight	King-Zeitler	McFarlan	Parker	Schacht	Triangle	Yellow Cab
Beggs	Concord Tr	Earl	Hanson	Kissel Tr	Menominee		Schwartz	Triumph	Young
Bell	Corinthian	Essex			Mitchell		Seagrave	Twin City	

W h e e l s

and
in Transmissions
and
on Differentials
and
on Pinion Shafts
and
on Worm Shafts
and
in Rear Wheels

Having proven capable of withstanding speeds even as high as 3,000 r p m in pinion mountings —

And successfully assimilating the thrust and shock loads of operation in transmissions —

While providing manifest advantages for the heavy radial loads encountered in rear wheel mountings —

Timken Tapered Roller Bearings naturally and amply provide the essentials which have made them dominant in front wheels

— where Timken adjustability for the wear which *must* follow motion is almost indispensable

The Timken Roller Bearing Co
CANTON, OHIO

Timken Tapered Roller Bearings in Motor Cars, Trucks, Tractors, Trailers, Farm Implements, Machinery and Industrial Appliances

TIMKEN

Tapered

ROLLER BEARINGS

NOTICE TO THE TRADE

Vacuum Tank Litigation—Court Decision

In the suit of Webb Jay and Stewart-Warner against Ireland & Matthews in the United States District Court for the Eastern District of Michigan, Southern Division, decree was entered at Detroit, March 30, 1922, by Judge Tuttle ordering injunction and accounting pursuant to oral opinion March 20th finding Jay patents valid and infringed by Weinberg tank.

This decision is being printed and copies thereof may be obtained at an early date on application to the undersigned.

STEWART-WARNER SPEEDOMETER COR'N
CHICAGO, U. S. A.

Stewart
PRODUCTS

IN USE ON 7 MILLION CA'R'S

Motor Wheel PRODUCTS



Wood
Wheels
for
Passenger Cars



Gier Tuarc
Steel
Wheels



Gier-Lewis
Light Car
Steel Wheels

THIS organization of specialists has served the automotive industry since the first days of car manufacture. The four great plants, manned by master artisans, operating the most modern machinery, build by methods which may well serve as a pattern for all such activity.

That is why Motor Wheel builds more wood wheels for motor trucks than any other maker in the world. That is why increasing millions of motor cars run on Motor Wheel passenger car wheels; why Gier Tuarc and Gier-Lewis wheels lead among steel wheels; and why Gier stampings are the quality standard of the industry.

MOTOR WHEEL CORPORATION
Lansing, Michigan

Motor Vehicle Wheels Complete — Metal Stampings — Steel Products
Gier TUARC and Gier-LEWIS Steel Wheels for Passenger Cars

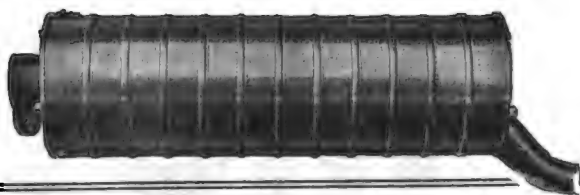
Motor Wheel
PRODUCTS



Gier Stampings



Wood Wheels
for Trucks



OUT of sight—out of mind
—the muffler is sure to
be neglected.

For mufflers are expected to
give trouble-free service for the
life of the car.

They should.

Yet the makers of 57 of
America's leading cars and
trucks have found only one that
will—

The Powell.

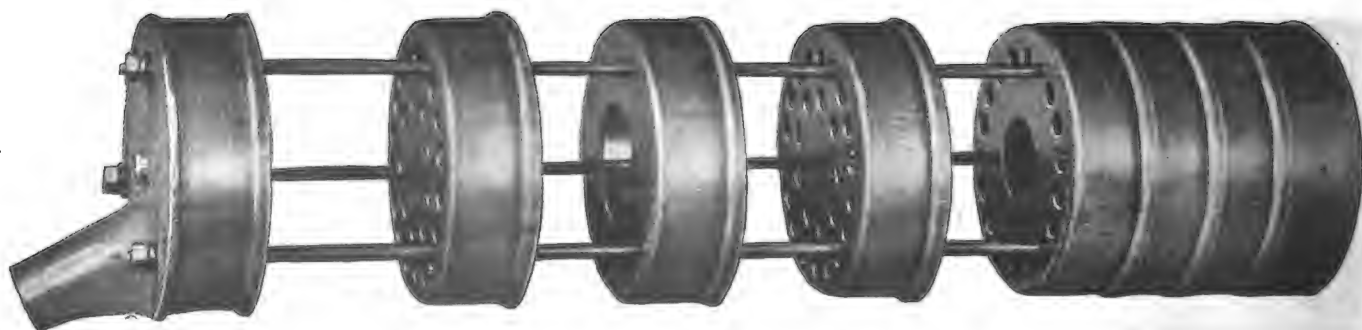
It is blow-out proof. Keeps
clean longest.

Factory equip with Powell
Mufflers.

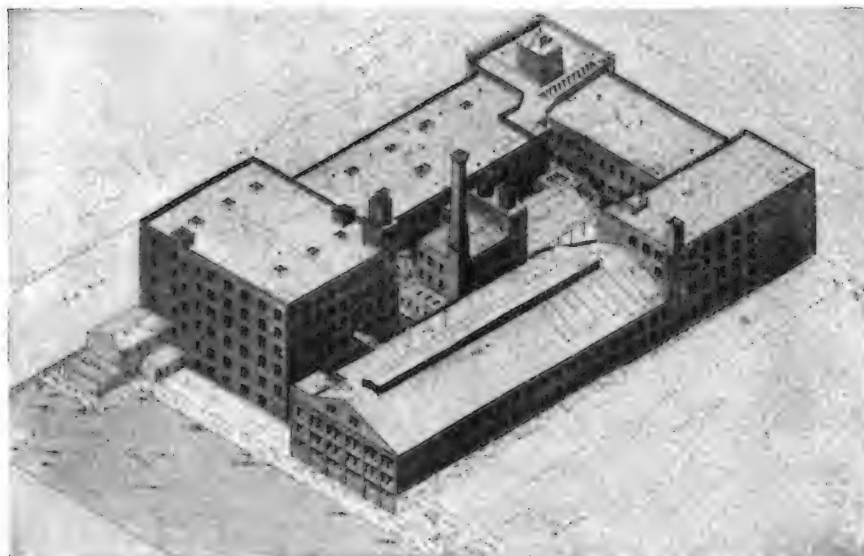
Powell Muffler Co., Utica, N. Y.

POWELL
~ M U F F L E R S ~

*Standard on
57 cars and
trucks*



For Sale—Two Plants in the New York Metropolitan District



THIRD AVE. and THIRD ST. BROOKLYN

On 5th Street Basin affording shipping facilities by water. Brick — mill construction — approximately 200,000 sq. ft. floor space.

Lot approximately 305 x 200 ft. 5 elevators, 8 ft. 6 in. square. Two enclosed shipping platforms. Trolley passes plant—subway 1 block.

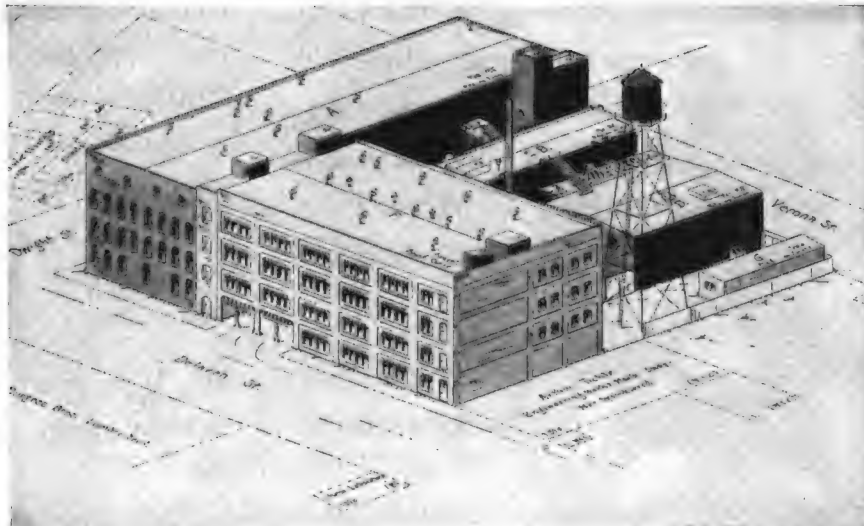
DWIGHT and VERONA STS. BROOKLYN

Faces public park—2 blocks from Atlantic Terminal (N. Y. Dock Co.) used by all railroads.

Floor space approximately 113,000 sq. ft.

Lot 200 x 200 ft.

3 elevators, 10 ft. square. Enclosed shipping platform accommodating 4 trucks. Trolley connecting with all parts of Brooklyn, 1/2 block away.

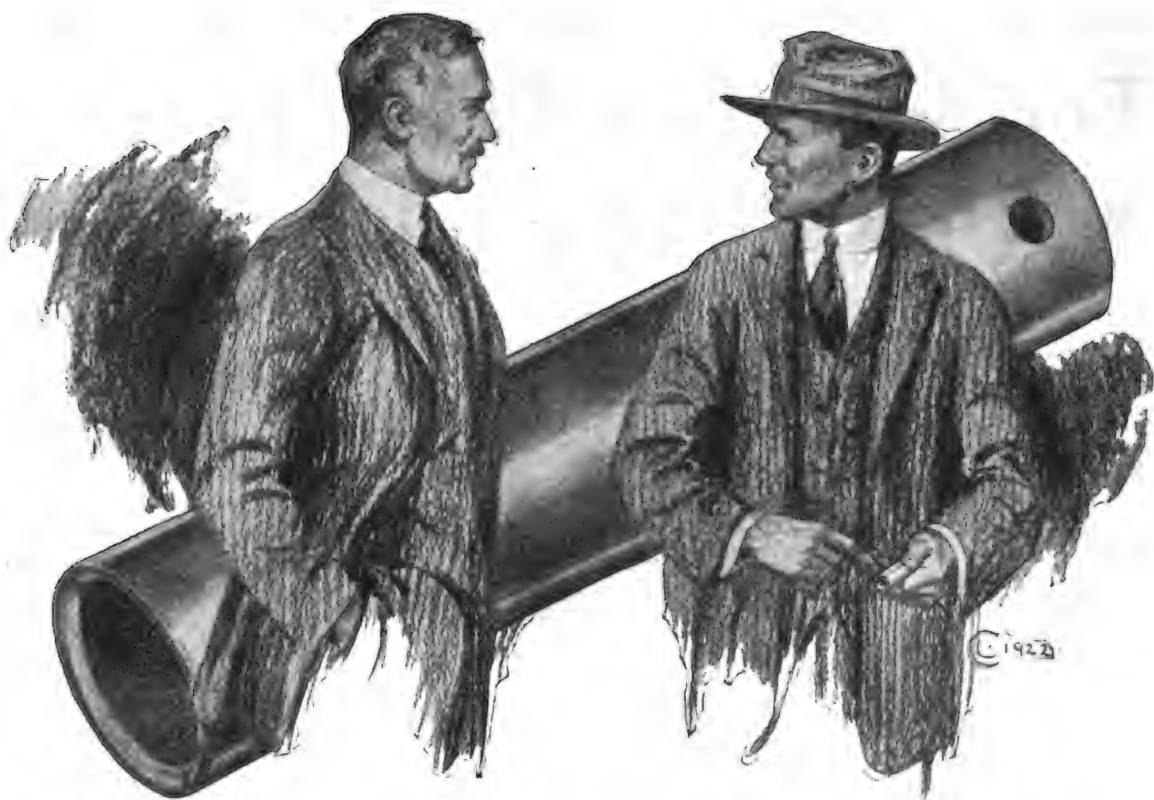


Concentration in large new building and redistribution of manufacturing operations among our various other factories makes it no longer necessary to operate these two plants in Brooklyn. They represent an unusual opportunity for the manufacturer wishing to locate in the Metropolitan District.

They are both conveniently situated, have complete power equipment, light and power wiring, automatic sprinkler systems and are steam heated. Daylight on all floors.

FOR DETAILS ADDRESS

AMERICAN CAN COMPANY, 120 Broadway, New York City



“How do you do it?”

“How do you do it?”—nine times out of ten we get this question when we show the Mirra Piston Pins. The extra value is so obvious that an extra price seems inevitable; yet Mirra Pins cost you no more than the ordinary kind.

Mirra Pins are ground on centers. We know they're right—accurate to

two ten-thousandths of an inch. Only the finest bar steel—S. A. E. specification—is used in machining the pins—hardened with especial care and all scale removed from the inside after hardening. The mirror finish—the feature that strikes the eye first—is found only in Mirra Pins.

We'll be glad to send price list and full information. Send blueprints.



WARREN F. FRASER CO.

Westboro

Mass.

MIRRA *Piston Pins*

131-9

VAN WHEELS

OF CAST METAL

Make Tires Wear Longer

VAN WHEELS of cast metal have distinct advantages. They do not warp or dish. A wheel just one degree out of true, facts prove, makes a tire drag 99-1/2 feet in every mile. Van Metal Wheels prevent this and save tires. They are true and concentric.

Ruinous friction heat reaches a temperature of 200 degrees in rubber tires on wood wheels. Van Metal Wheels absorb and radiate the heat of the tires, thus adding to tire life.

Van Metal Wheels are hollow spoke, distinctive, light in weight, yet have great strength. The absence of a felloe band makes for low peripheral weight. Compare their weight, price and strength with any other wheel.

It's simple to change to the safe, efficient Van Wheel. No change in manufacturing methods. Cost no more than the best grade hickory—much less than other metal wheels.

Made in all standard sizes. Write for information.

Van Wheel Corporation

Office—SYRACUSE, N. Y.

Factory—ONEIDA, N. Y.

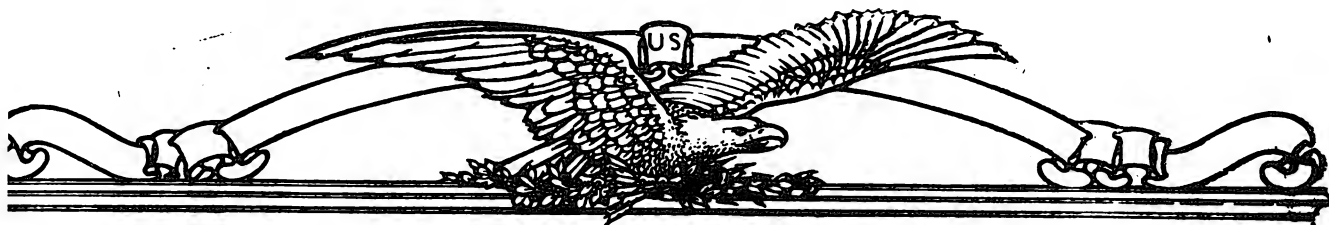
VAN WHEELS

- Are light as wood.
- Have low peripheral weight
- Are easily cleaned.
- Are distinctive in design.
- Will not warp or dish.
- Will radiate heat, adding to tire life.
- Make oiling and greasing points accessible.
- Are guaranteed.



The Weight of Van Wheels
in Different Sizes

30" x 3 1/2"	16 1/2 lbs.
32" x 4"	20 lbs.
34" x 4 1/2"	25 1/2 lbs.
36" x 6"	40 lbs.
40" x 8"	44 lbs.



1¼ Million Pounds Brass Discs ***for Sale by Sealed Bid*** ***May 5, 1922, at Edgewood Arsenal, Md.***

Approximately 1,238,000 pounds of brass discs, weighing from 3½ to 4 pounds to the disc will be sold by Sealed Bid, to be received until 10:00 A. M. Eastern Time May 5, 1922, at the address given below. The material is stored at Edgewood Arsenal where it may be inspected each day, Sundays and holidays excepted.

Terms of Sale

10% of the amount bid in the form of cash, certified checks or other legal tender must accompany the bid. An additional 10% of the purchasing price will be required within 48 hours from the award to the successful bidder. The material is to be loaded at the purchaser's expense and removed within 60 days from date of acceptance. It is sold "as is" "where is" without warranty or guarantee as to analysis, grade, quantity or condition. The Government reserves the right to reject any or all bids. Proposals are to be signed by the bidders and enclosed in a sealed envelope marked "Proposal for sale of Brass Discs, to be opened 10:00 A.M. Eastern Time, May 5, 1922," and addressed to the undersigned. For proposal blanks and full conditions of sale address:

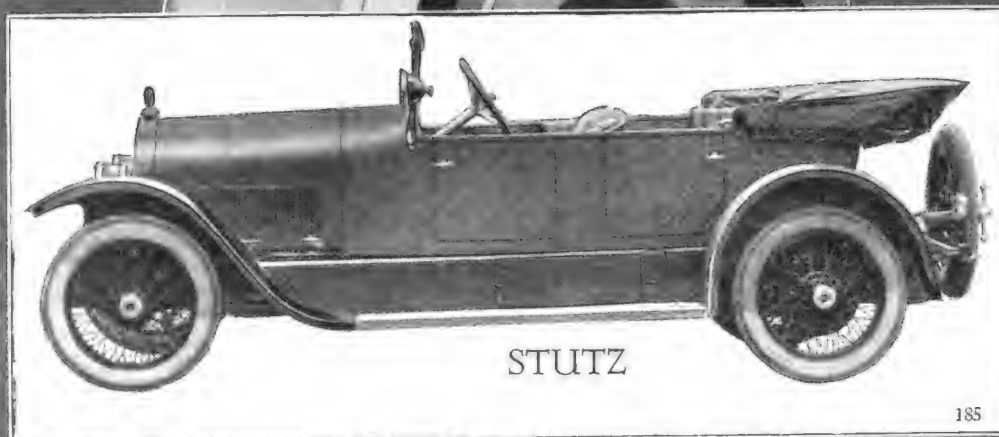


Property Officer
Chemical Warfare Service
Edgewood Arsenal, Edgewood, Md.

WAR DEPARTMENT

Strom

BEARINGS



Strom Bearing Equipped

U. S. BALL BEARING MFG. COMPANY

(Conrad Patent Licensee)

4535 Palmer Street - CHICAGO, ILLINOIS

Economy and Mock Turtles

First-Cost Economy is like the Mock Turtle that Alice met in her dream. It has never been encountered in real life. And mock turtle soup, as every epicure knows, is merely a synthetic parody on the genuine article.

The plant executive learns the truth about First Cost, sooner or later. It is a wholesome lesson, though often an expensive one.

But sometimes it keeps its secrets hidden. You are conscious of a steady drain on profits, but can't trace it to its source. Old First Cost is at it again—but you can't tell *how* and you don't know *where*.

Look In The Assembling Department

Watch your workmen bolting on parts. And note when the wrench strikes a snag—when the nut sticks or refuses to take hold. Experience has taught the workman that you can't lick that kind of nut; so he takes it off again, throws it aside and hunts for a good one to replace it. There's a good bit of precious time simply tossed into the discard. And if you stay around a while you will see it happen again, and again, and again.

That's where your profits are going. Somebody's low bid has opened a leak—and a constant labor waste in assembling is the result.

Where The Schedule Misses Fire

You may point to the operating schedule and say: "But that's all accounted for. There's bound to be a certain percentage of defective nuts in any shipment, low price or high. So we allow for it in the schedule, as part of the cost of production. And cost isn't profit—so where is the leak?"

The leak is in the schedule itself—in introducing a cost that shouldn't exist.

It is true, as the schedule maker avers, that nuts purchased in quantities from the average sources will yield their share of "scrap." Defects are inevitable where a semi-finished cold punched nut must pass through seven machines during the progress of its manufacture—with seven operators to handle it and seven set-ups to make, and quantity production to consider.

But why should *you* be the loser—why should you be obliged to resort to expedients in the schedule to cover up a labor loss, just because the nut maker can't deliver a 100% uniform product?

"Scrap" Has Found Its Master

The producers of Empire Cold Punched Nuts have

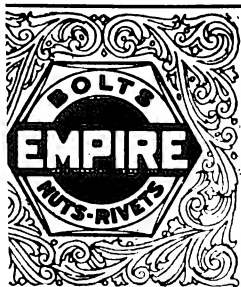
developed a new process of nut making that eliminates the mechanical factors responsible for the error and loss of accuracy that feature the conventional methods.

The five machines ordinarily required for cold punching, chamfering, trimming, retrimming and burnishing have been replaced by an automatic nut machine that performs all the five operations in one. These automatics work with flawless precision—producing nuts, ready for tapping and semi-finishing, whose accuracy has not been impaired by frequent handling and numerous set-ups.

A finished Empire Nut is a model of close tolerances and structural perfection. Its threads gauge to within .003". Its fit is clean and true. It is everlastingly strong—fracturing and thread stripping are unheard of.

Every Empire Nut is like that—which means that no Empire Nut will cause trouble in assembling. And where there is no "scrap"—where every nut responds smoothly to the touch of the wrench—there will be no wasted labor.

Figure what it means to stop the time leaks that add so to the cost of production, and you measure the gain that Empire Nuts bring to assembly practice.



RUSSELL, BURDSALL & WARD
BOLT & NUT COMPANY

PORT CHESTER, N.Y.

PEMBERWICK, CONN. • CHICAGO • SAN FRANCISCO • ROCK FALLS, ILL.

Makers of Bolts, Nuts, and Rivets Since 1845



PRESSED STEEL FRAMES

Passenger Cars
Motor Busses
Trucks
Trailers

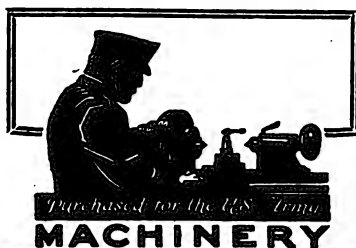
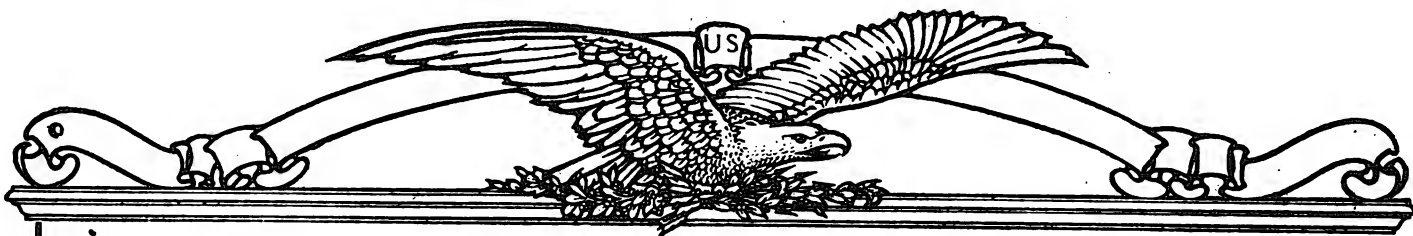
MISCELLANEOUS STAMPINGS

Brake Drums—Axle Housings and Covers—Running Boards
Step Hangers—Motor Supports—Torque Arms—Fender Brackets
Tire Carriers—Body Brackets, Etc.

*Our Engineering Department is at your service in helping you select
suitable designs to meet your requirements. Write us.*

PARISH & BINGHAM CORP.
CLEVELAND, OHIO





Miscellaneous and Engineering

IN THESE TWO WAR

AT JEFFERSONVILLE, INDIANA

MAY 9th, 1922

Blowers

Boilers, 125 H.P.

Planer Machines

Refrigerating Plant

Parts

Pulverized Rottenstone

Medical Carts

Countershaft Castings

Manila Rope $\frac{1}{2}$ " and $\frac{3}{4}$ "

Moulding Tables

Welding Machines



AT CHICAGO, ILLINOIS

MAY 11th, 1922

Slugging Machines

Brass Toggles

Trucks, Electric, 4-Wheel

Skiving Machines

Steel Bands, 40 x 6

Starting Rheostats

Parts for Gas Engines

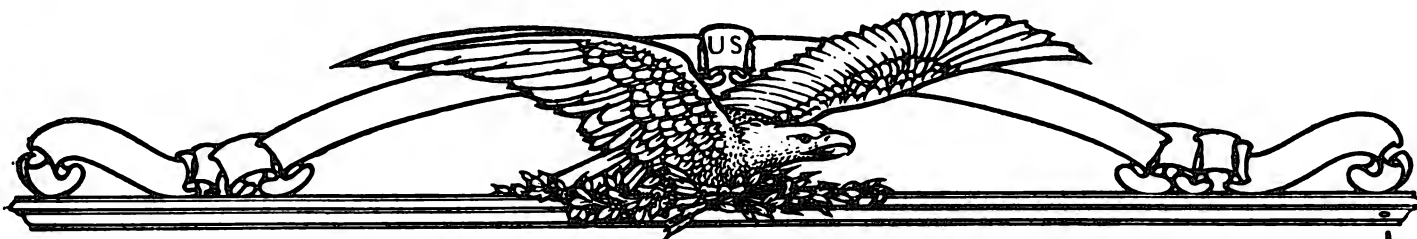
Subsistence Stores and Commissary

Supplies

Manila Rope, 2 $\frac{1}{2}$ "

Miscellaneous Hardware

WAR DEPT



Machinery, Electric Trucks Supplies—

DEPARTMENT AUCTION SALES

Miscellaneous Machinery, 4-Wheel Electric Trucks, Starting Rheostats, Gas Engine Parts and Steel are but a few of the items to be offered at these two War Department Auction Sales. All of the material offered is in good condition, and is available for immediate removal upon purchase. Catalogs listing in detail every item offered at each sale will be sent at your request. A few of the commodities, together with date and place of sale are listed on opposite page.

QUARTERMASTER SUPPLY OFFICER

General Intermediate Depot
1819 West Pershing Road Chicago, Illinois

Other material to be offered at these two sales include Leather and Harness, Animal Drawn Vehicle Parts, Clothing and Textiles, Office Fixtures, etc., etc. The Government reserves the right to withdraw any lots or parts of lots offered.

Examination of the detailed catalogs will quickly show you chances to profit from these sales. Send for them today. Address:

**Quartermaster
Supply Officer**

General
Intermediate Depot
1819 West Pershing
Road
Chicago, Illinois

ARTMENT



SUPREME AUTO OIL
Leaves Less Carbon

CONCLUSIVE

"I'VE been storing my car with that garage for more than a year. At the start he wanted my oil trade, but after a time I found his oil was not satisfactory.

"I suggested SUPREME AUTO OIL to him but he seemed sold on his particular 'no-name' brand and I noticed he did a very light oil business with his storage customers.

"Finally he stocked this SUPREME and he tells me it is the best thing he has done—his business in oil has grown beyond his rosiest dreams.

"Personally, I have found it satisfactory—it does *Leave Less Carbon*—and I would not attempt Winter driving with any other oil."

Look for the Sign of the Orange Disc.

GULF REFINING COMPANY

General Sales Offices: Pittsburgh, Pa.

District Sales Offices:

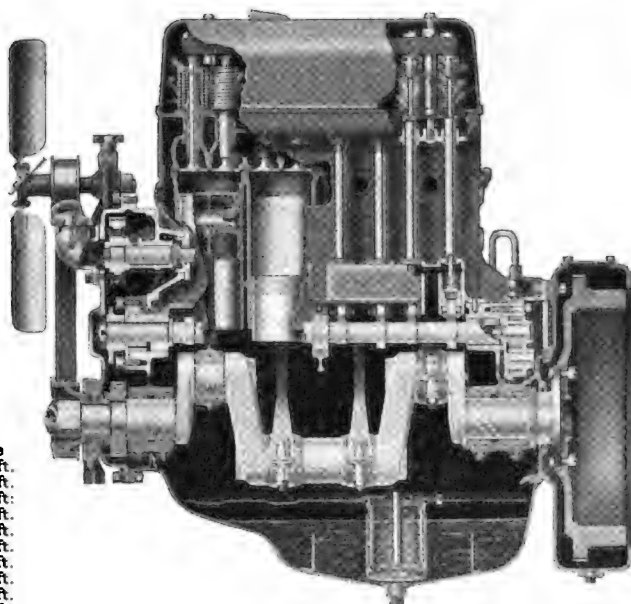
New York
Atlanta

Philadelphia
New Orleans

Boston
Houston

MIDWEST

COMMERCIAL CAR POWER PLANTS



MODEL 409
4 Cyl. 3¼ x 4½ inch

R.P.M.	H. P.	Torque
600	10	85 lbs. ft.
800	13.25	88 lbs. ft.
1000	16.80	90 lbs. ft.
1200	20.20	91 lbs. ft.
1400	23.80	90.5 lbs. ft.
1600	27.00	89 lbs. ft.
1800	29.60	87 lbs. ft.
2000	31.70	84 lbs. ft.
2200	33.30	81 lbs. ft.
2400	33.80	74 lbs. ft.
2600	33.00	65 lbs. ft.

Midwest Engines are Sold on the Basis of Performance

That's fair, isn't it?

We could advertise startling facts based on bore and stroke, thermal efficiencies, materials used, and many obscure points. Rather than that, however, *Midwest Engines* are advertised on the basis of *performance*.

They do their own speech-making. Subjected to rigid tests on the road and dynamometer, they have proved to commercial car manufacturers their performance-ability.

To What End?

To the end that many truck manufacturers desiring to deliver *Honest Service to the User* have adopted the *Midwest Engines*. The commercial car manufacturer who is interested in equipping his truck with an engine without peer in economy of operation, dependability and performance-ability will choose the *Midwest Engine*.

You owe it to the equipment you are marketing to specify, and see that you *get*, a *Midwest Engine*.

Sales Division No. 18

MIDWEST ENGINE COMPANY - Indianapolis, Indiana

DEPENDABLE POWER

FORGET BORE AND STROKE — — IT'S PERFORMANCE THAT COUNTS



A Real Horn for a Real Car

—a horn that *is* a horn—a powerful motor-driven horn. At the slightest touch of the button on the steering column, the Basco Horn sounds a warning—not offensive but commanding and distinctive in tone—appropriate for passenger car or motor truck. It's a road clearer.

The loudness of the warning is adjustable. The simple turning of a single screw modulates the tone to suit. Where it's set it stays. Mechanism is simple, sturdy and clean-cut throughout.

Basco is the most horn for least money. And it lasts. Operates without oil—no congealing of

oil or dry bearings to impair its ever dependable operation. The Basco Horn needs no attention whatever.

The big value in this horn will surprise you. Write us for quantity price and horn for try-out. Give it your hardest test.

Other



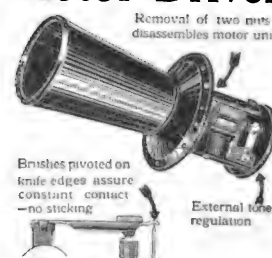
products

Switches
Instrument Panels
Door Handles

Pillar and Compartment Locks, Electrical Specialties, etc.

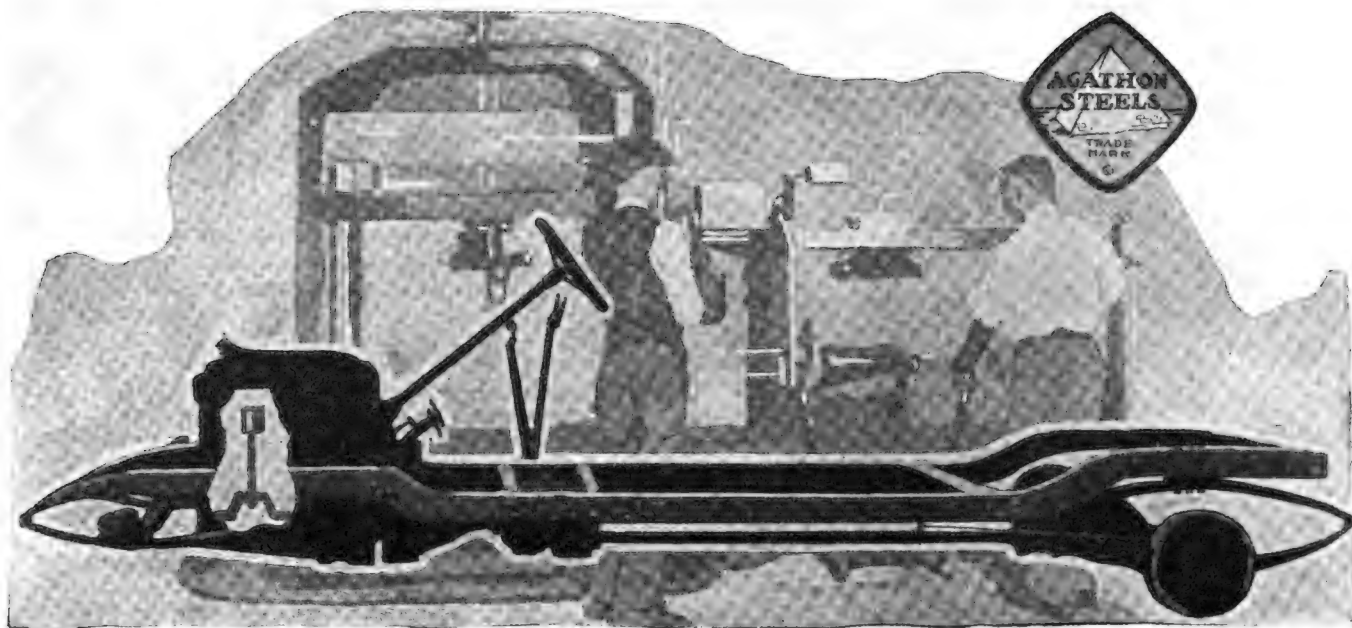
(Locking and Non-Locking)

Motor Driven



A powerful electric motor oscillates a large diaphragm giving the distinctive Basco tone. Any one who knows the Basco Horn instantly recognizes its commanding r-r-r-x-x! Motor armature rides on special impregnated fibre bearings that need no lubrication. This means no failures to operate due to congealed oil or dry bearings. One screw removes motor cover—2 small nuts remove armature for inspection. Every part simple and sturdy.

Briggs & Stratton Co.
Milwaukee  Wisconsin



Note the adaptability of this

Alloy Steel For Chassis Parts

Steels yielding a wide range of tensile strength are required for the numerous constructional parts of the automobile chassis.

One of the outstanding achievements of our alloy steel mills has been the production of UMA-2, (one of the UMA series), a steel which by a single temperature change in heat treatment can be made to yield any strength from 95,000 pounds to 200,000 pounds per square inch.

To the production manager charged with the economical production of chassis parts of unvarying quality, UMA-2 means fewer steels to be carried in stock and much greater ease and uniformity in machining and heat treating operations.

The alloy steels of the UMA series also include several other analyses covering nearly every degree of strength and hardness. We also produce nickel, chrome-nickel, vanadium, molybdenum and special analyses steels, special high finish automobile sheets and hot rolled strip steel.

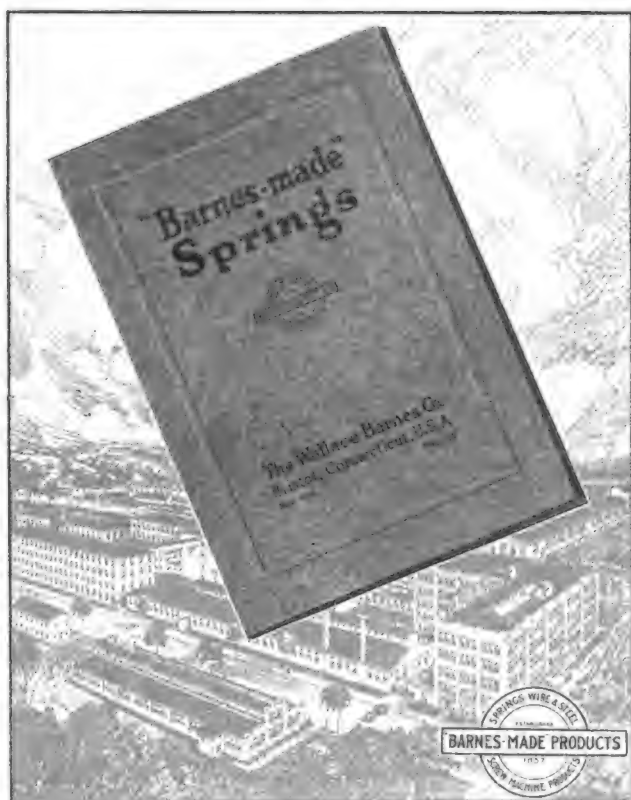
Write to us for information regarding the adaptability of UMA-2 steel for such parts as Axle Shafts, Front Axles, Piston Rods, Crank Shafts, Connecting Rods, Drive Shafts, Steering Arms, Knuckles, Studs, Bolts, Nuts, etc. We will gladly mail on request photographic chart showing physical properties and analysis of this water-quenching alloy steel.

The Central Steel Company

MASSILLON, OHIO

Cleveland, Detroit, Syracuse, Philadelphia, Chicago

UMA-2



SPRINGS

can never be completely catalogued. Every day writes a new chapter in the manufacture of these small engines.

A sketch of our experience, however, in producing literally thousands and thousands of different Springs for every conceivable purpose is crowded within the pages of our Booklet No. 9.

You will, perhaps, find represented there just the sort of Spring to settle some difficulty you may have.


You will want one of these Booklets on your desk, anyway.

The Wallace Barnes Co.

"Spring Makers for Three Generations"
Bristol, Connecticut

Western Office, Book Bldg. Detroit

Exhibiting at Booth No. 70, N.A.P.A.
Informashow, Rochester, N. Y., May 14-20th



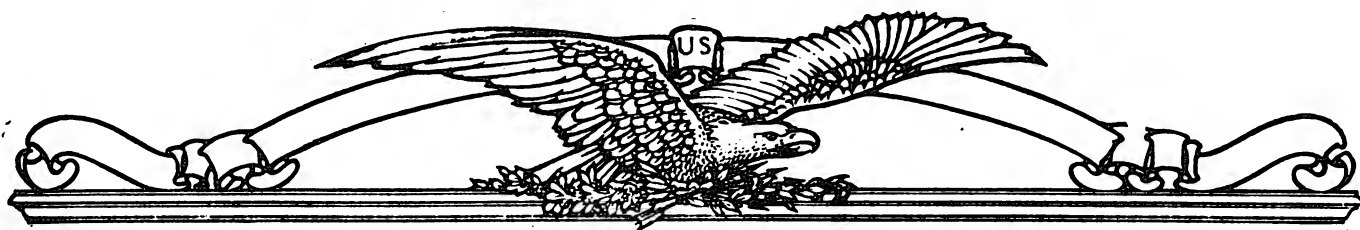
Character in a Metal Product

Character is made, not born, in a metal product. It is formed during each of many operations, any one of which can materially affect its life—its usefulness. The Van Dorn Organization realizes this—every operation being so performed as to add—not lessen—these important and predominating characteristics, and so you will find our gears differing from others—possibly not in general appearance but in those invisible, lasting and durable qualifications. Our fellow craftsmen can unquestionably be of great service to you if given the opportunity.

Gear Craftsmen Since 1897

THE VAN DORN & DUTTON COMPANY

CLEVELAND, O., U.S.A.



A Heavy Tonnage of Steel, Brass, and Other Metals Offered in Two Sealed Bid Sales—

PICATINNY ARSENAL, DOVER, N. J., MAY 10th
TOLEDO ORDNANCE RESERVE DEPOT, OHIO, MAY 12th



Terms of Sale

Proposal blanks for material at Picatinny and The Toledo Ordnance Reserve Depot each carry the Terms of Sale for the lots they cover. They will be sent upon request upon application to the addresses at the bottom of the lists elsewhere upon this page. Send for them today.

Bids Close

For the Picatinny lots bids will be received until 1 P.M. May 10, 1922, at the Office of the Commanding Officer, Picatinny Arsenal, Dover, N. J. For the Toledo material bids will be received until 2 P.M. May 12, 1922, at the Office of the Chicago District Salvage Board, 74th St. and South Ashland Ave., Chicago, Ill.

At Picatinny Arsenal
Dover, N. J.

Materials in 40 lots.

These lots include such commodities as Scrap Steel, 23 to 879 gross tons per lot, made up of Adapters, Booster Caps, Plugs, Bushings, etc.; Soft Steel Forgings; Brass Scrap; Zinc Scrap; Lead Scrap; Copper Tubing; Set Screws in lots of 700 to 125,000; Rolls Red Rosin Paper; Wooden Cases with and without linings; Tin Cans; Scrap Silk Cloth; Crinoline; Asbestos Cement in Bags; Aluminum; Sheet Iron; Khaki Webbing; Smokeless and Black Powder; Mixed Acid; Ammonia; Miscellaneous Tools, etc.

For Proposal Blank Write:

**Commanding
Officer,
Picatinny Arsenal,
Dover, N. J.**

At
Toledo, O.

Copper, Lead, Zinc, Antimony, Brass.

**396305lb Copper
8-inch rotating
bands**

**862107lb Copper
10-inch rotating
bands**

**22996lb Copper
6-inch rotating
bands**

**1950lb Copper
37 m m rotating
bands**

5200lb Lead Pigs

**17000lb Antimony in
Pigs**

**21000lb Zinc Anodes
3000lb Scrap Brass
3000lb Brass Bars.**

*For Proposal Blanks
Address:*

**Chicago District
Ordnance Salvage
Board,**

**74th Street and
S. Ashland Ave.
Chicago, Ill.**

Sales aggregating a billion dollars from over one hundred thousand individual orders — such is the record of War Department Sales

WAR DEPARTMENT

Be guided by 79 years' experience



The Spring Perch Company's experience spreads over 79 years, and to-day their plant records the last word in scientific spring production.

The co-operation of our engineering staff is offered to the automotive industry to aid in solving individual problems encountered in *CAR*, *TRUCK* and *BUS* manufacture.

We invite inquiries as to your requirements for any type of car, truck or bus in prospect and can offer pertinent and perhaps valuable suggestions regarding your spring suspension problems.

For *PLEASURE CARS* we recommend our new type of front spring, affording remarkable increase in easy riding conditions, which eliminates the sharp jolts and disagreeable pitching action so common.

For *TRUCKS* we recommend the banded spring for stability and longer life. Essential where the Hotchkiss drive is employed. No shifting of springs on axle and no center breakage.

For *BUSES* we recommend our specially designed compound spring, which reduces vibration and affords a fine riding condition under their greatly varying loads.

Makers of High Class Springs Since 1843

SPRING PERCH COMPANY

STRATFORD CONNECTICUT



Type VW Spot Welder

*Profit by
the War
and
A. E. F.*

BASE your spot welder decision on facts — not guesses.

Type "VW" A. E. F. is the greatest advance in spot welders ever made.

In your own interests you should investigate. Our engineers are ready to call—wire us or send for full information.

The American Electric Fusion Corp.
972 Montana St., Chicago, Ill.
Branch Office: 1424 Dime Bank Bldg., Detroit



LUNKENHEIMER

Needle Valve Priming Cups

An original Lunkenheimer conception; simple in design, and very dependable for priming Automotive units. The bodies are made of steel with the handles of brass.

The materials and workmanship are of that high order which characterizes all Lunkenheimer Products and adds to the efficiency of the unit to which they are attached.

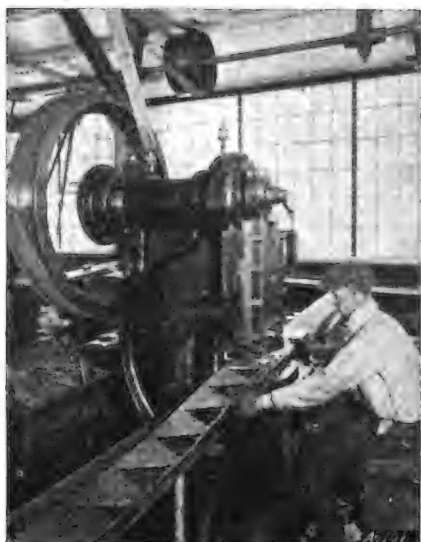
Write for catalog No. 5-HK.

THE LUNKENHEIMER CO.
QUALITY

LARGEST MANUFACTURERS OF
HIGH-GRADE FUEL-INJECTION SPECIALTIES
NEW YORK IN THE WORLD BOSTON
CHICAGO CINCINNATI U.S.A. LONDON
REPAIR DEPT. 129-135 LAFAYETTE ST., NEW YORK

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SHEET METAL WORKING MACHINERY



"Stiles" Punching Press on a blanking job

"STILES" PUNCHING PRESSES

Specially adapted for heavy punching and stamping work. Frames designed to give maximum strength and rigidity. Entire pressure through solid metal. Graduated eccentric adjustment.

Universally used in the manufacture of hardware, locks, cutlery, sewing machines, typewriters, etc., etc.

Built in a large number of sizes and different styles. With deep or narrow throats. Solid or adjustable tables. Write us your individual requirements. There is one that will just fit in.

"For Efficiency and Economy"

"Specify Bliss Presses"

"Standard the World over"

E. W. BLISS CO. MAIN OFFICE AND WORKS BROOKLYN, N. Y., U. S. A.

SALES OFFICES: DETROIT Dime Bank Bldg. CLEVELAND Union Bank Bldg. CHICAGO Peoples Gas Bldg. PITTSBURGH Keenan Bldg. ST. LOUIS Boatmen's Bank Bldg. BUFFALO Marine Bank Bldg. CINCINNATI Union Trust Bldg. NEW HAVEN Second Nat'l Bank Bldg.

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No. 196

An Advance in Universal Joint Construction!

"M & E"

Griptide
UNIVERSAL JOINTS



The radial folds of the Disc provide a perfect grip with the specially Formed Washers of unique design.

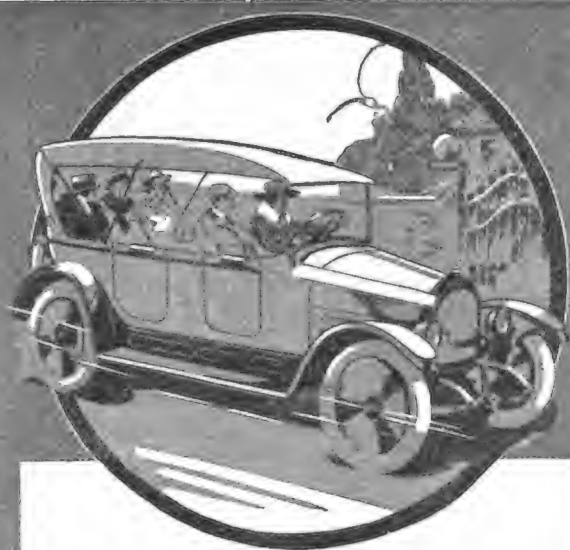
"M & E" GRIPTITE UNIVERSAL JOINTS

alone possess this distinctive feature. It means better grip, permanent true alignment; with longer life on large angles and with heavy torque.

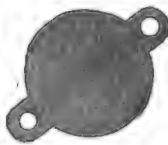
Write for Details.

MERCHANT & EVANS CO.

Philadelphia



It has the greatest
wear resistance
of any insulator—



That is what makes
Vul-Cot fibre so popular
for moving parts
that must function as
insulators.



Its great density, toughness
and its low friction
co-efficient all combine
to give it enormous electrical
and wear resistance.

Then too it machines as
easily as lead, and that
goes a long way toward
helping solve the problem
of production cost.



It comes in sheets, rods
and tubes, or we will
gladly machine parts to
your specifications.



An extremely interesting
little booklet—"The Material
With a Million Uses"—
will suggest many ways in
which *Vul-Cot* Fibre can
save cost in your production.

AMERICAN VULCANIZED FIBRE CO.
599 Equitable Building, Wilmington, Del.

SALES OFFICES
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NEW YORK PITTSBURGH DETROIT ST. LOUIS

Complete Stock for Immediate Shipment at Chicago
Western Agents Canadian Agents
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SAN FRANCISCO SEATTLE MONTREAL TORONTO WINNIPEG
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VANCOUVER

Interstate

Refined — Open Hearth

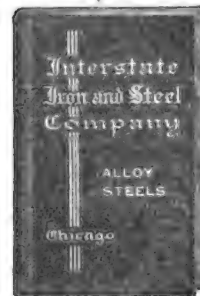
ALLOY STEEL

Bars, Billets, Slabs, Blooms, Spring Steel,
Cold Drawn Annealed and Heat-Treated Bars,
Wire Rods, Wire Rivets and Wire Products—

are making an enviable place for themselves in the estimation
of leaders in the automotive
industries.

*S A E specifications
and special analyses*

Send for this Pocket Manual of -
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Heat Treatment.



Free to responsible Buyers of, and workers in, Alloy Steels.

Interstate Iron & Steel Co.

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Detroit, Cleveland, St. Louis, St. Paul, Milwaukee, New York,
San Francisco, Kansas City, Cincinnati.

Why

do all the big Nut Plants and Industrials use the

National Automatic (Bent Tap) Nut Tapper



in tapping nuts for
automobile, truck,
aeroplane, motor-
cycle, sewing machine,
electrical,
and for other particular
service?

If you make good
quality nuts in appreciable
quantities it will pay you to
investigate.

**The National
Machinery Co.**
Tiffin, Ohio, U. S. A.



"MILWAUKEE" BEARINGS

for

Motor Cars, Trucks, Tractors

Milwaukee bronze back babbitt lined bearings—machined throughout and lined with babbitt of your analysis—are parts with built-in quality that looms large in the life of the motor into which they are assembled.

A process of bonding, used by us exclusively, eliminates loose linings, and our method of casting is a guarantee against porosity; specifications and blue prints are followed to the letter—the result is bearings with a reputation second to none for longevity.

Send us your blueprints and specifications for estimates.

DIE CASTINGS

Zinc, tin and lead base die castings are other "Milwaukee" products used in great quantities by the industry. The services of our engineering department are available on your die casting problems.

Milwaukee Die Casting Co.

297 Fourth Street

Milwaukee, Wis.



GASOLINE TANKS

Prompt delivery, combined with high class workmanship, is very desirable—but right now, both are very hard to obtain.

In view of this condition, automobile and truck manufacturers will find

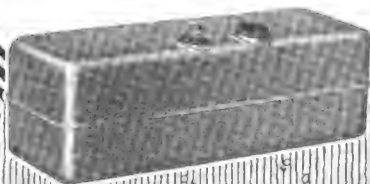
G.P.&F. SERVICE
KNOWING HOW SINCE '01

—specialized products and exceptional manufacturing facilities—invaluable to them.

We can assure prompt delivery on orders of any size—any type or size of tank, either welded or lock-seamed—a complete service at your service.

Our large, modern plant, covering 15 acres and our 40 years in making pressed steel parts, deserve your consideration.

Send us a sample or blue print and let our special Tank Dept. furnish you with an estimate.



GEUDER, PAESCHKE & FREY CO.

1422-1700 St. Paul Ave.

MILWAUKEE, WISCONSIN

Detroit Office: 712 Dime Bank Bldg.

Why it costs less to clean with Oakite

Because (1) You spend less for cleaning materials

An ounce of Oakite has a greater cleaning power than 8 to 16 oz. of sal soda, soda ash or caustic cleaners. A metal specialty manufacturer makes a direct saving of \$6.74 a day by using Oakite materials instead of sal soda, besides indirect savings through better cleaning results.

Because (2) Oakite has longer life

An electrical works formerly used an alkali cleaner and had to make up its cleaning tank every day with fresh materials. With Oakite, tank is only made up once every 8 weeks. Thus \$24.50 worth of Oakite is doing as much work as \$367.60 worth of former cleaner.

Because (3) You stop rejects

A motor car factory when cleaning fenders, etc., with caustic soda, had rejects after japanning as high as 15%. Since using Oakite materials, work is cleaned so thoroughly the japan takes perfectly. No rejects.

Because (4) You save on labor

An eastern manufacturing company now cleans its small metal parts with Oakite materials because this eliminates the labor of 5 girls formerly employed to scrub the parts with soap after having been soaked in soda ash solution.

Because (5) You can clean faster

A gear plant formerly used kerosene to clean its big gears ranging up to 30 feet diameter. It took 2 men 2 entire days to clean one gear. With Oakite materials 1 man cleans a big gear in 1 hour—or 16 times faster.

What does it mean to you in dollars and cents to use a cleaner such as Oakite? Get your answer from a practical test in your own shop or plant. Clean some of your work under the competent supervision of one of our 60 Service Men. Then compare the result and judge for yourself whether it is worth while to regularly use Oakite.

It incurs no obligation to ask us to send a Service Man to have a friendly talk with you. Get the facts. A line from you will bring one of our men to your plant within a few days.

OAKITE

**MANUFACTURED BY
OAKLEY CHEMICAL CO.
28 THAMES STREET • NEW YORK**

*Seven in Less Time Than It Takes
To Make One*



Here Is a Good Illustration of Reducing Costs by the Condensite Method

ABOVE is a photograph of a group of seven post insulators used on the North East coil unit, just as it appears when taken from the multiple cavity mold. (The plate shaped fin at the base of the posts was made exceptionally heavy in order to hold them together while photographing.)

The old method of making these posts was to machine them from fibre, hard rubber or similar materials. Each part was made separately and required a buffing operation in order to give it a finished appearance.

The new and more economical way is by putting the required amount of Condensite powder into a multiple cavity mold containing places for seven post insulators, placing the mold in a press and in a few minutes you have seven complete parts finished in every detail, not even requiring a buffing operation, as the Condensite takes the polished surface of the mold. Still another feature is the refinement in design made possible by the use of Condensite, such as the high thin wall guard which protects the terminal nut connections.

The most important result is that seven complete parts are made in less time than it took to make one.

It is part of our engineering staff's duty to evolve such economies wherever possible. We invite your inquiries.

Condensite

CONDENSITE COMPANY OF AMERICA
BLOOMFIELD, NEW JERSEY



WHEREVER There is ANNOYING VIBRATION

There Is a Need for Our Services

An organization of trained vibration specialists, devoting their entire time and energy to the study of this one problem, can unquestionably be of great assistance to you.

Every automobile manufacturer who has been wise enough to install one of our balancing machines has found it of material aid in improving the riding qualities of his cars.

Let us solve your vibration problems.

VIBRATION SPECIALTY COMPANY

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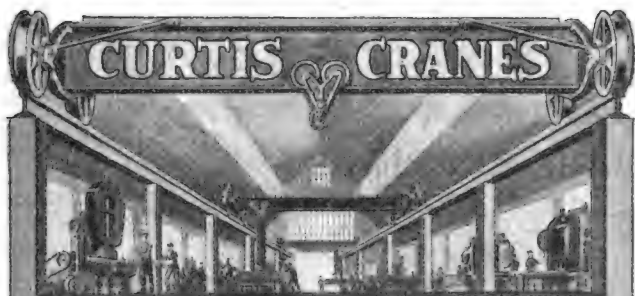
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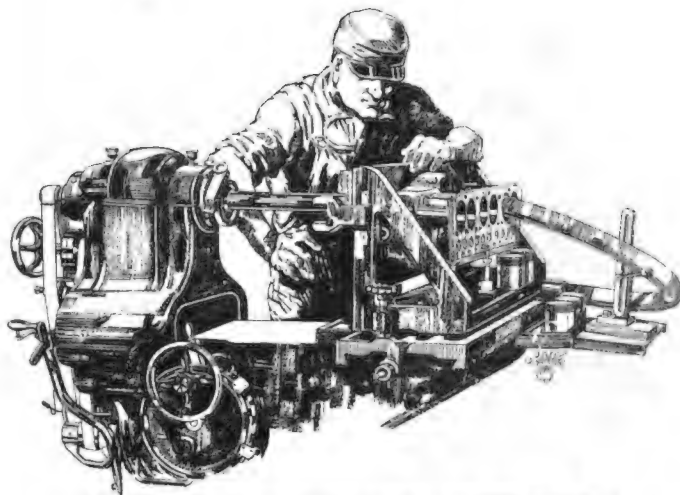
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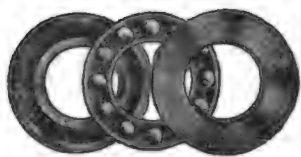
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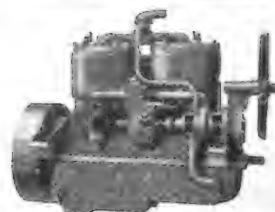
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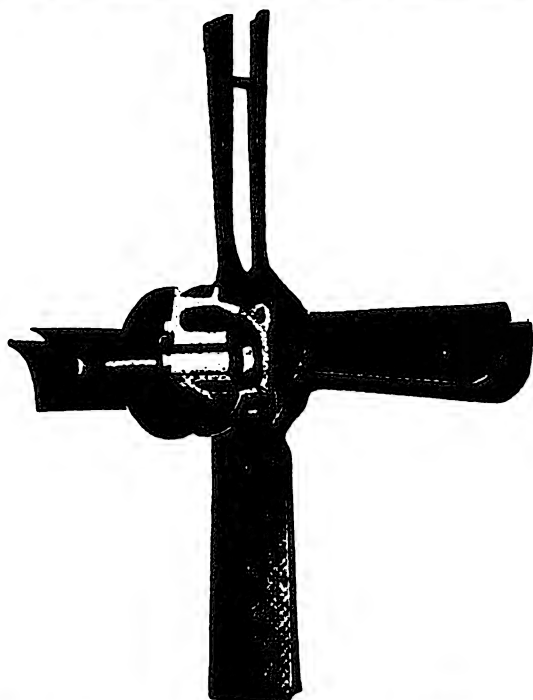
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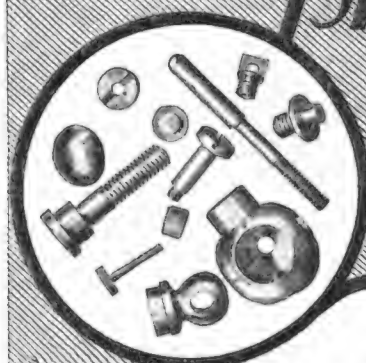
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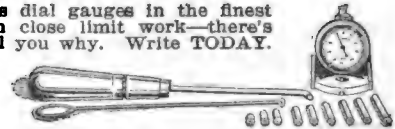


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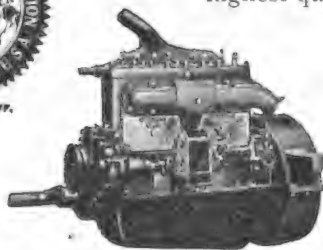
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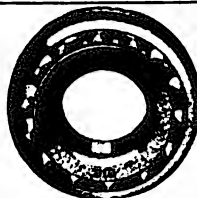
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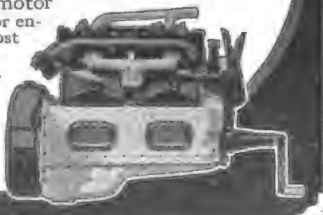
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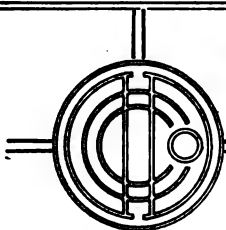
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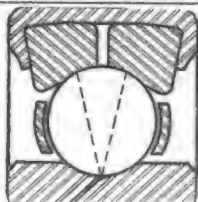
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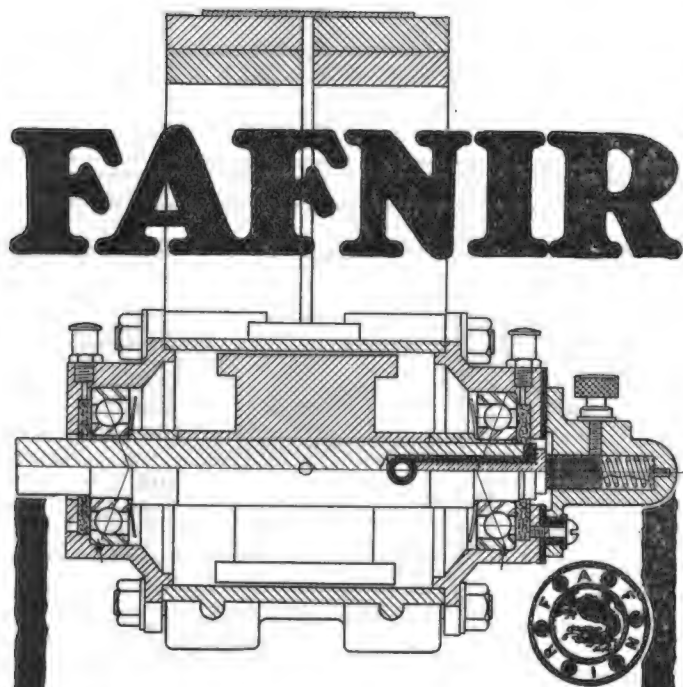
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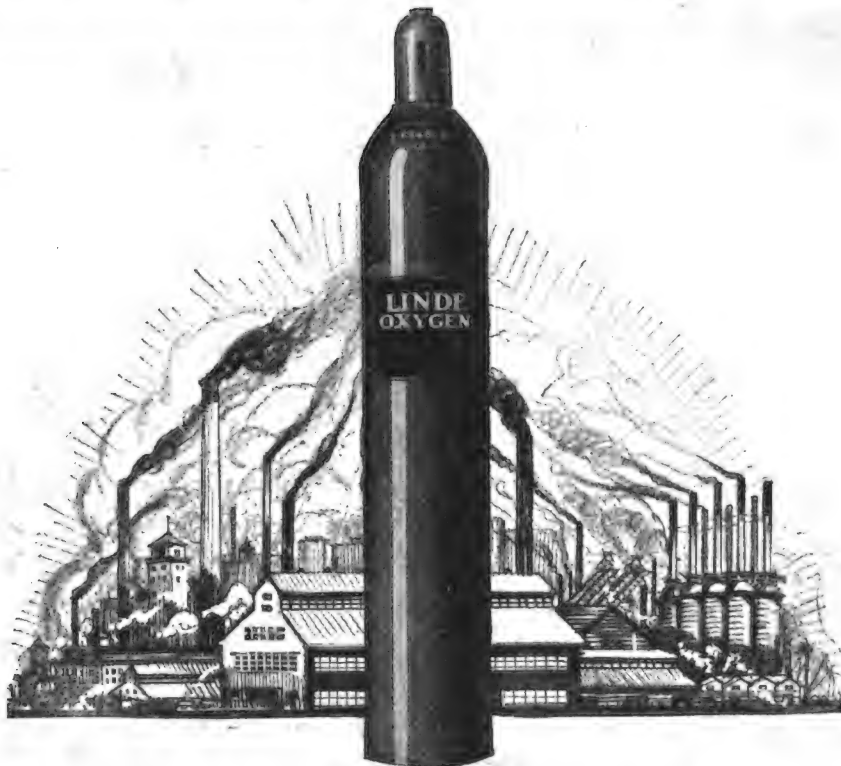
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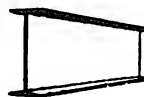
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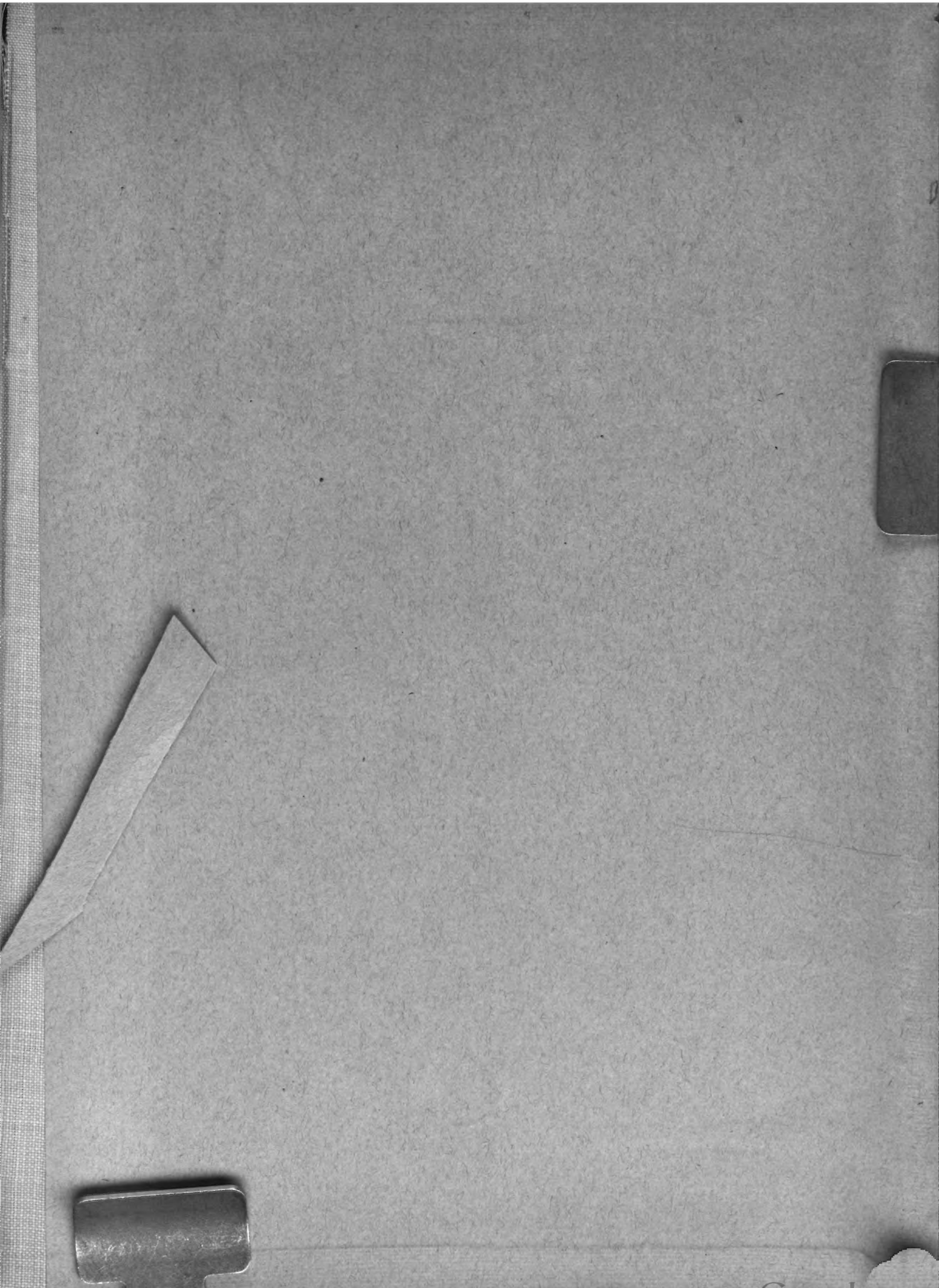


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